UKPSC 2026

FOOD SAFETY OFFICER

Part-1

FOOD TECHNOLOGY

NODIA

CHAPTERWISE MCQ BANK

- 3000+ MCQs with Full Explanation
- As per Syllabus released by UKPSC

Scan QR for Demo PDF

Nodia

GET ALL STUDY MATERIAL IN ONE APP!

- Textbooks
- Previous Year Chapterwise Question Banks
- 30 Sets Sample Papers
- Worksheets

FREE!

DOWNLOAD NOW!

SCAN & DOWNLOAD

GET IT ON Google Play

UKPSC 2026

FOOD SAFETY OFFICER

FOOD TECHNOLOGY

Part-1

Chapter-wise MCQ Bank
As Per Syllabus Released By UKPSC

NODIA

Downloaded from www.pdf.tube

UKPSC Food Safety Officer Part-1
Edition June 2026
Published by : NODIA
An Imprint of NODIA EDITIONS LLP

Information contained in this book has been obtained by author, from sources believes to be reliable. However, neither NODIA nor its author guarantee the accuracy or completeness of any information herein and NODIA nor its author shall be responsible for any error, omissions, or damages arising out of use of this information. This book is published with the understanding that NODIA and its author are supplying information but are not attempting to render engineering or other professional services.

© NODIA EDITIONS LLP

MRP ₹750.00

NODIA EDITIONS LLP
125, Sector 6, Vidyadhar Nagar, Jaipur 302039
Phone :+91 9001005245
email : mail@nodia.in

CONTENTS

Unit 1. Food Chemistry and Human Nutrition

Ch 01	Macronutrients: Carbohydrates, Proteins and Fats	9
Ch 02	Micronutrients: Vitamins and Minerals	45
Ch 03	Food Contaminants: Heavy Metals, Pesticides and Adulterants	81
Ch 04	Anti-Nutritional Factors and Enzymes in Food	121
Ch 05	Nutraceuticals, Functional Foods, Organic Foods and Genetically Modified Foods	159
Ch 06	Colouring and Flavouring Agents	199
Ch 07	Nutrition, RDA, Balanced Diet and Malnutrition	236

Unit 2. Food Microbiology and Food Hygiene

Ch 08	Principles of Food Microbiology and Role of Microorganisms	273
Ch 09	Foodborne Pathogens, Food Poisoning, Food-Borne Diseases and Antimicrobials	311
Ch 10	Sources of Microorganisms and Microbiological Quality of Foods	348
Ch 11	Microbiological Examination, MPN and Indicator Microorganisms	385
Ch 12	Beneficial Microorganisms: Single Cell Protein (SCP), Prebiotics and Probiotics	422
Ch 13	Temperature-Based Microbial Groups in Processed Food	457

Click Here to Buy book on Amazon

Unit 3. Food Preservation, Processing and Packaging

Ch 14	Processing of Plant-Based Foods	496
Ch 15	Processing of Beverages, Sugar, Jaggery and Confectionery	530
Ch 16	Processing of Animal-Based Foods	565
Ch 17	Food Preservation: Principles, Methods and Emerging Technologies	601
Ch 18	Food Additives and Packaging	637
Ch 19	Labelling, Storage, Transportation and Street Foods	674
Ch 20	By Product Utilisation of Food Industry	709

****

NODIA

Syllabus and Exam Scheme of the written exam (Objective Type) for the Post of Food Safety Officer under Food Safety and Drug Administration Department, Uttarakhand

➢ Exam Scheme

Exam scheme for the post of Food Safety Officer is as follows-

1. Written exam (Objective Type)

S. No	Subject	No. of Questions	Maximum Marks	Time
1	FOOD TECHNOLOGY AND GENERAL STUDIES	200	200	03 Hours

2. Interview (Personality Test) – 25 Marks

Note:-**1**. The written examination will be of objective type, in which the negative evaluation method will be adopted. For each wrong answer given by a candidate to a question or for more than one answer given by a candidate to the same question (even if one of the answers given is correct), one-fourth (1/4) mark of the marks prescribed for that question will be deducted.

2. Final Merit list will be prepared on the basis of a total of marks obtained by the candidate in the Written Exam and Interview/Personality Test.

Downloaded from www.pdf.tube

➢ SYLLABUS FOR FOOD SAFETY OFFICER

"FOOD TECHNOLOGY AND GENERAL STUDIES"

Total Questions: 200 **Total Time: 3hrs** **Total Marks: 200**

Part A: Food Technology

Total Questions: 180 **Total Marks: 180**

NODIA

Unit 1. Food Chemistry and Human Nutrition

Structure and functions of carbohydrates**,** protein, fat, and vitamins. Occurrence of minerals, toxicity of heavy metals (As, Cd, Pb, Hg etc.) and pesticides. Anti-nutritional factors and their effect on human health; methods of their removal from foods. Role of Enzymes in food processing**.** Nutraceuticals and functional foods, organic foods, genetically modified foods. Natural and synthetic colouring; flavouring agents and their impact on human health. Food and nutrition, its functions, classification and sources. Balanced diet and recommended dietary allowance (RDA), Food contaminants, adulterants and their effects on human health. Causes and prevention of malnutrition.

Unit 2. Food Microbiology and Food Hygiene

Principles of food microbiology, role of microbes in food quality, fermented food, food spoilage, food borne pathogens, poisoning and diseases. Sources of microorganisms in food chain (raw materials, water, air, equipment and handler etc.) and methods of evaluating microbiological quality of foods-culture dependent and culture independent methods with special reference to yeast, mould, protozoan, bacteria and virus. Principles and techniques in microbiological examination of foods and water. Indicator microbes, Presumptive test (Most Probable Number) and confirmatory count methods. Beneficial microorganisms and their role in food processing. Single Cell Protein (SCP), Prebiotics and Probiotics. Methods of detecting, Anti-microbial resistance in food and water borne pathogens. Role of microbes affecting the quality & shelf life of processed foods with special emphasis on psychrophiles, mesophiles, halophiles and thermophiles.

Unit 3. Food Preservation, Processing and Packaging

Principles and Operations of Food Processing in food grains, pulses, legumes, edible oil seeds, fruits, vegetables, spices, condiments, Tea, Coffee, sugar, jaggery, confectionery, bakery, beverages, dairy, egg, meat and aqua food

products. Food preservation, its principles and methods including novel and emerging technology. Food additives with respect to their technological functions and safe limits. Food packaging methods and principles including novel packaging materials and techniques. Food labelling, storage and transportation practices. Ready to eat Indian street foods. By product utilization of food industry.

Unit 4. Food Analysis and Quality

Fundamentals of field and laboratory sampling with statistical tools, maintenance of chain of evidence and transportation conditions in terms of aerobic and anaerobic microbes. Basic/classical methods of food analysis. Analytical techniques including HPLC, GC, AAS, NIR, NMR, FTIR, TEM, SEM, Fluorescent microscopy, UV-VIS Spectrophotometry, GC-MS and molecular techniques. Food quality definition, attributes and role in food industry. Sensory quality evaluation and its methods. Principles and need of quality assurance and quality control. Detection of common adulterants in various foods products. Methods of detecting toxins. Principles of food safety management system including traceability and recall - Sanitation, Hazard Analysis Critical Control Points (HACCP), Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP), Good Agricultural Practices (GAP) and Good Hygienic Practices (GHP). Legal aspects related to food safety. Food safety management system (FSMS)- ISO: 22000; Quality Management system (QMS)- ISO: 9001. Total Quality Management. ISO certification. Food Fraud, Personal Hygiene, Pest and Rodent control; Food Plant sanitation and Hygiene. Food Hazard. Methods of detecting radiation and radioactivity.

Unit 5. Indian and International Food Laws

Food Safety and Standards Act of India 2006 and Food Safety and Standards Rules and Regulations – 2011: Provision, definitions and different sections of the act and implementation. Role of relevant national bodies, e.g. APEDA and Spice Board etc. International Food Control Systems/Laws, Regulations and Standards/Guidelines with regard to Food Safety: CODEX Alimentarius Commission (CAC) - history, members, standard setting and advisory mechanism, Joint Expert Committee on Food Additives (JECFA), Joint FAO/WHO Expert Meeting on Microbiological Risk Assessment (JEMRA), Joint meeting on Pesticide Residues (JMPR), WTO agreements - Sanitary and Phyto Sanitary measures/Technical Barriers to Trade (SPS/TBT) related to food items. National and international accreditation bodies and procedures. Bureau Indian Standard (BIS), AGMARK, Coffee Board, Tea Board, Essential commodities act, Consumer protection act.

Click Here to Buy book on Amazon

Unit 6. Food Safety and Standards Authority of India (FSSAI) : Role, Functions and Initiatives

Structure and Functions of Food Authority, systems and processes in Standards, Enforcement, Laboratory ecosystem, imports, Third Party Audit etc. Promoting safe and wholesome food (Eat Right India, Food Fortification, Special Nutrition Programme (SNP)), Clean Street Food Hub, Repurpose Used Cooking Oil (RUCO), hygiene rating and various other social and behavioural change initiatives. Role of State Food Authorities.

Unit 7. Public Health Challenges

Definition, history and current scenario of Public Health. Concept of Health and Disease. Determinants and Dimensions of Health; Level of prevention. Clinical and dietary survey, Programs of nutrition in India (Mid-day meals at schools, Anganwadi systems, ICDS, NIDDCP, NNAPP, WIFS, National food security mission, SABLA, FSSAI initiatives on food fortification, FFRC). Importance of diet in alleviating health risks, especially non-communicable diseases and increasing cancer cases. Epidemic dropsy, Lathyrism, Epidemic fluorosis, Iodine deficiency disorder (IDD) etc. Epidemic, endemic and pandemic, out-break investigation and their methods.

Part B: General Studies

Total Questions:20 **Total Marks:20**

Unit 8. General Studies

General Science; Computer Literacy; Current events of State, National and International importance; History of India, Indian National Movement, Indian Polity, Economy, Geography; Population, Culture, Sports, Food & Agriculture, Religion, Festivals etc. with special reference to Uttarakhand.

Downloaded from www.pdf.tube

CHAPTER 01

Macronutrients: Carbohydrates, Proteins and Fats

1. Which of the following best represents the approximate daily energy requirement proportion derived from macronutrients in a balanced diet for a healthy adult?
(A) Carbohydrates 30-35%, Proteins 45-50%, Fats 15-20%
(B) Carbohydrates 15-20%, Proteins 25-30%, Fats 45-50%
(C) Carbohydrates 35-40%, Proteins 35-40%, Fats 15-20%
(D) Carbohydrates 55-60%, Proteins 10-15%, Fats 20-30%

2. Match the carbohydrate categories in List I with their respective examples in List II:
List I: Carbohydrate categories
P. Monosaccharide
Q. Disaccharide
R. Polysaccharide
S. Oligosaccharide
List II: Examples
I. Fructooligosaccharide
II. Galactose
III. Glycogen
IV. Maltose
(A) P-II, Q-III, R-IV, S-I
(B) P-IV, Q-II, R-I, S-III
(C) P-II, Q-IV, R-III, S-I
(D) P-III, Q-I, R-IV, S-II

3. Which of the following statements correctly defines macronutrients in the context of human nutrition?
(A) They are organic compounds required in milligram quantities to catalyze metabolic reactions and cellular processes.
(B) They are nutrients required in large quantities to provide energy, structural components, and vital substrates.
(C) They are essential inorganic minerals required in trace amounts to maintain osmotic balance and cellular integrity.
(D) They are non-caloric organic components that primarily facilitate the absorption of dietary vitamins and minerals.

4. Consider the following statements regarding the structural properties of polysaccharides:
1. Starch is a polymer composed exclusively of beta-D-glucose units.
2. Cellulose contains beta-1,4-glycosidic bonds that human enzymes cannot hydrolyze.
3. Glycogen is highly branched, primarily containing alpha-1,4 and alpha-1,6 linkages.
4. Inulin is a polysaccharide composed predominantly of fructose units.
Which of the statements given above are correct?
(A) 1, 2 and 3 only
(B) 2, 3 and 4 only
(C) 1, 3 and 4 only
(D) 1, 2, 3 and 4

NODIA

A Food Safety Officer is inspecting a batch of commercial milk suspected of being adulterated with a thickening agent. Upon adding iodine solution to the milk sample, a distinct blue-black colour develops. Which macronutrient is confirmed to be present as an adulterant?
(A) Starch
(B) Whey protein isolate
(C) Liquid glucose
(D) Hydrogenated fat

6. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Cellulose provides zero metabolizable energy to the human body despite being a carbohydrate.
Reason (R): The human digestive system lacks the enzyme beta-1,4-glycosidase required to break the linkages in cellulose.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

7. A sports nutritionist is formulating a pre-event meal for a marathon runner. The objective is to maximize muscle glycogen storage without causing rapid spikes and crashes in blood sugar. Which of the following carbohydrate sources is most conceptually appropriate for this specific application?
(A) High-amylose corn starch
(B) Pure liquid dextrose
(C) Fructose syrup
(D) Highly branched maltodextrin

8. Consider the following statements regarding complex carbohydrates:
Statement I: Amylose is a highly branched component of starch that provides a gel-like consistency when heated in water.
Statement II: Amylopectin is an unbranched, linear component of starch that readily forms crystalline structures.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

9. All of the following carbohydrates are classified as reducing sugars, except:
(A) Glucose
(B) Sucrose
(C) Lactose
(D) Maltose

10. During an inspection of a processing facility, a Food Safety Officer finds that honey is being extensively substituted with an artificially produced syrup. The laboratory report shows the syrup consists of equal parts glucose and fructose, produced by the hydrolysis of a common disaccharide. What is the precise nature of this adulterant?
(A) High Fructose Corn Syrup (HFCS)
(B) Liquid malt extract
(C) Invert sugar syrup
(D) Agave nectar

11. Identify the incorrect pair regarding disaccharides and their constituent monosaccharide units:
(A) Sucrose – Glucose and Fructose
(B) Lactose – Glucose and Galactose
(C) Maltose – Glucose and Glucose
(D) Cellobiose – Glucose and Fructose

12. What is the primary physiological effect of an increased intake of soluble dietary fibre in the human gastrointestinal tract?
(A) Gel formation delaying glucose absorption and lowering blood cholesterol
(B) Accelerated gastric emptying paired with highly rapid nutrient absorption
(C) Irreversible enzyme binding that prevents effective protein hydrolysis
(D) Mechanical digestion of cellulose resulting in a highly elevated energy yield

13. Arrange the following carbohydrates in the correct sequence from highest to lowest relative sweetness:
1. Glucose
2. Fructose
3. Sucrose
4. Lactose

(A) 2, 3, 1, 4
(B) 3, 2, 1, 4
(C) 2, 1, 3, 4
(D) 3, 1, 2, 4

14. Identify the incorrect statement regarding the structure and properties of glycogen:
(A) It is the primary storage form of carbohydrates in animals and humans.
(B) It has fewer alpha-1,6 branching points compared to plant amylopectin.
(C) It is stored predominantly in the liver and skeletal muscles.
(D) Its highly branched structure allows for the rapid mobilization of glucose molecules.

15. Which of the following best defines a glycosidic bond in the context of macronutrients?
(A) A covalent bond linking a carbohydrate to another group, which may or may not be a carbohydrate.
(B) A covalent bond formed between two adjacent amino acid residues with the loss of a water molecule.
(C) An ester bond formed between three fatty

Click Here to Buy book on Amazon

acid chains and a glycerol backbone to produce a lipid.
(D) A non-covalent hydrogen interaction that stabilizes the secondary structure of polysaccharides.

16. Which enzyme initiates the digestion of carbohydrates in the human oral cavity?
(A) Pancreatic alpha-amylase
(B) Lingual salivary lipase
(C) Salivary alpha-amylase
(D) Intestinal maltase enzyme

17. Match the carbohydrate-digesting enzymes in List I with their primary site of action or secretion in List II:
List I: Carbohydrate-digesting enzymes
P. Salivary amylase
Q. Pancreatic amylase
R. Sucrase
S. Pepsin
List II: Site of action or secretion
I. Small intestine brush border
II. Mouth
III. Small intestine lumen
IV. Not involved in carbohydrate digestion
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-I, R-III, S-IV
(C) P-I, Q-III, R-IV, S-II
(D) P-II, Q-III, R-I, S-IV

18. Which of the following statements correctly describes the absorption of glucose in the small intestine?
(A) Glucose is absorbed primarily via passive diffusion directly across the intestinal membrane.
(B) Glucose absorption requires active ATP hydrolysis by the GLUT2 transport protein on membranes.
(C) Glucose enters the enterocyte against its gradient via the SGLT1 transporter and sodium ions.
(D) Glucose is converted into short-chain fatty acids before entering the abdominal lymphatic system.

19. Consider the following statements regarding the absorption and metabolism of monosaccharides:
1. Fructose is absorbed via facilitated diffusion using the GLUT5 transporter.
2. Galactose shares the same sodium-dependent transporter (SGLT1) as glucose.
3. Once absorbed, all monosaccharides are transported directly to the liver via the hepatic portal vein.
4. Fructose metabolism in the liver bypasses the key regulatory enzyme phosphofructokinase.
Which of the statements given above are correct?
(A) 1 and 2 only
(B) 2, 3 and 4 only
(C) 1, 3 and 4 only
(D) 1, 2, 3 and 4

20. A food technologist is formulating a meal replacement shake intended for diabetic individuals. Which of the following ingredient modifications would most effectively ensure a low glycaemic index (GI) for the final product?
(A) Replacing intact whole grains with finely milled refined wheat flour
(B) Increasing the proportion of maltodextrin and reducing dietary fibre
(C) Gelatinizing the starch completely through extensive hydrothermal processing
(D) Incorporating beta-glucan and replacing sucrose with isomaltulose

21. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Foods with a high Glycaemic Index (GI) cause a rapid and steep increase in blood glucose levels.
Reason (R): High GI foods contain complex carbohydrates that are highly resistant to the action of digestive amylases.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

22. Resistant starch (RS) functions similarly to dietary fibre and is fermented in the colon. Which application demonstrates the use of Type 3 Resistant Starch (RS3) in food processing?
(A) Adding raw, unmodified potato starch to a cold beverage.
(B) Extruding and fully gelatinizing corn starch to make a highly digestible puffed snack.
(C) Cooking and subsequently cooling rice to promote retrogradation before consumption.

NODIA

(D) Chemically modifying starch with cross-linking agents to withstand high shear forces.

23. Consider the following statements:
Statement I: Glycaemic Load (GL) takes into account both the quality (GI) and the quantity of carbohydrates in a specific food portion.
Statement II: A food with a high Glycaemic Index will always have a high Glycaemic Load, regardless of the serving size consumed.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

24. All of the following food processing factors typically result in a lower Glycaemic Index (GI) of the final product, except:
(A) Presence of intact botanical structures (e.g., whole seeds)
(B) Increased addition of soluble dietary fibre
(C) High lipid and protein content in the food matrix
(D) Extensive milling and particle size reduction of grains

25. A clinical case study evaluates a patient consuming a strict diet. The patient exhibits severe episodic hypoglycaemia. To manage this by providing a slow, sustained release of glucose into the bloodstream, which of the following food matrices should be recommended?
(A) Boiled white potatoes and carrots
(B) Whole intact barley and lentils
(C) Puffed rice cereal and white bread
(D) Watermelon and sweet glucose syrup

26. Identify the incorrect pair regarding carbohydrate metabolic pathways:
(A) Glycolysis – Breakdown of glucose to pyruvate
(B) Glycogenesis – Synthesis of glycogen from glucose
(C) Gluconeogenesis – Breakdown of glycogen to release free glucose
(D) Pentose Phosphate Pathway – Generation of NADPH and ribose-5-phosphate

27. What is the physiological cause-and-effect relationship of chronically consuming a diet characterized by a very high Glycaemic Load?
(A) Decreased insulin secretion leading to enhanced lipid oxidation in adipose tissues
(B) Enhanced systemic synthesis of glucagon resulting in rapid skeletal muscle hypertrophy
(C) Reduced hepatic glycogen storage leading to spontaneous acute hypoglycaemic shock
(D) Chronic hyperinsulinemia leading to insulin resistance and Type 2 diabetes

28. Which of the following represents the most appropriate nutritional significance of utilizing the Glycaemic Index (GI) concept in diet planning?
(A) It predicts postprandial blood glucose responses to assist in glycaemic control.
(B) It dictates the exact caloric value of a meal to ensure consistent weight loss.
(C) It calculates the daily total protein requirement based on carbohydrate intake.
(D) It determines the specific vitamin and mineral density of carbohydrate foods.

29. Identify the incorrect statement concerning glycolysis in human metabolism:
(A) It occurs entirely and exclusively within the cellular cytoplasm of the cell.
(B) It directly yields a net production of 36 ATP molecules per glucose molecule.
(C) It can readily proceed under both metabolic aerobic and anaerobic conditions.
(D) Under anaerobic conditions, pyruvate is reduced to lactate to regenerate NAD+.

30. Which of the following defines gluconeogenesis?
(A) The hepatic synthesis of glycogen polymers from excessive levels of dietary glucose.
(B) The generation of glucose from non-carbohydrate substrates like amino acids.
(C) The chemical hydrolysis of glycogen reserves in the liver during prolonged fasting.
(D) The physiological conversion of adipose-derived dietary fatty acids into glucose.

31. Which of the following is a classic example of a simple protein?
(A) Serum albumin
(B) Hemoglobin
(C) Lipoprotein
(D) Nucleoprotein

Downloaded from www.pdf.tube

32. Match the protein classification in List I with its appropriate example in List II:
List I: Protein classification
P. Simple protein
Q. Conjugated protein
R. Derived protein
S. Incomplete protein
List II: Examples
I. Peptones
II. Zein
III. Globulin
IV. Casein
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-I, R-IV, S-II
(C) P-III, Q-IV, R-I, S-II
(D) P-II, Q-IV, R-I, S-III

33. Which of the following statements correctly describes the structural nature of amino acids?
(A) They strictly contain only carbon, hydrogen, and oxygen atoms in their native biochemical state.
(B) They possess both an amino group and a carboxyl group attached to different carbon atoms.
(C) All twenty standard amino acids possess a highly non-polar, hydrophobic side chain structure.
(D) At physiological pH, they exist as zwitterions with both positive and negative charges.

34. Consider the following statements regarding amino acids:
1. Leucine, isoleucine, and valine are branched-chain essential amino acids.
2. Tyrosine is considered an essential amino acid for healthy adults.
3. Histidine is essential for infants but its requirement in adults is minimal.
4. Alanine and aspartic acid are non-essential as they can be synthesized by the body.
Which of the statements given above are correct?
(A) 1 and 2 only
(B) 1, 3 and 4 only
(C) 2, 3 and 4 only
(D) 1, 2, 3 and 4

35. A Food Safety Officer is tasked with evaluating the quality of a new plant-based protein isolate. To accurately determine its true impact on human nutrition, which competency-based metric is currently recommended by the FAO/WHO as the most accurate standard?
(A) Biological Value (BV)
(B) PDCAAS
(C) Protein Efficiency Ratio (PER)
(D) Net Protein Utilization (NPU)

36. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Cereals and legumes are often consumed together in traditional diets to ensure adequate protein nutrition.
Reason (R): Cereals are typically deficient in lysine, while legumes are deficient in methionine; together they provide complementary proteins.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

37. A food manufacturer wants to create a vegan nutritional bar with a complete essential amino acid profile using only single-source plant ingredients. Which of the following ingredients should they apply as the primary protein source to achieve a PDCAAS close to 1.0?
(A) Soy protein isolate
(B) Active wheat gluten
(C) Defatted peanut flour
(D) Hemp seed protein

38. Consider the following statements regarding protein quality evaluation:
Statement I: The Protein Efficiency Ratio (PER) is determined by measuring the weight gain of a growing animal divided by its protein intake.
Statement II: Biological Value (BV) measures the proportion of absorbed protein from a food that becomes incorporated into the proteins of the organism's body.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

NODIA

39. All of the following are considered essential amino acids for adult humans, except:
(A) Glutamine
(B) Methionine
(C) Phenylalanine
(D) Tryptophan

40. An epidemiological survey in a drought-affected region reveals infants presenting with edema, fatty liver, depigmented hair, and severe lethargy, despite receiving a diet sufficient in basic caloric requirements but lacking in quality. What is the most likely diagnosis?
(A) Marasmus
(B) Pellagra
(C) Scurvy
(D) Kwashiorkor

41. Identify the incorrect pair regarding metrics of protein quality:
(A) Biological Value (BV) – Nitrogen retained / Nitrogen absorbed
(B) PDCAAS – Measures weight gain of rats relative to standard casein diet
(C) Net Protein Utilization (NPU) – Nitrogen retained / Nitrogen intake
(D) Chemical Score – Ratio of the most limiting amino acid in a test protein to that in a reference protein

42. What is the direct effect of a diet restricted to a protein source lacking one essential amino acid (the limiting amino acid)?
(A) The missing amino acid is spontaneously synthesized from fatty acids.
(B) The body upregulates the synthesis of non-essential amino acids to substitute the missing one.
(C) Protein synthesis halts, and the remaining amino acids are deaminated for energy.
(D) The absorption of all other macronutrients is permanently inhibited.

43. Arrange the following events of protein digestion in the correct sequential order:
1. Activation of pepsinogen to pepsin
2. Hydrolysis of polypeptides into oligopeptides by pancreatic proteases
3. Cleavage of dipeptides into free amino acids by brush border peptidases
4. Denaturation of tertiary protein structures by gastric HCl

(A) 4, 1, 2, 3
(B) 1, 4, 2, 3
(C) 4, 2, 1, 3
(D) 1, 2, 4, 3

44. Identify the incorrect statement regarding the biological quality of proteins:
(A) Net Protein Utilization (NPU) is always equal to or greater than the Biological Value (BV).
(B) Egg protein is often used as a reference standard because its BV is nearly 100.
(C) Heating can sometimes improve protein digestibility by denaturing the protein structure.
(D) Animal-source proteins generally have a higher PDCAAS than single plant-source proteins.

45. Which of the following definitions correctly describes protein denaturation?
(A) The complete enzymatic hydrolysis of peptide bonds resulting in free amino acids.
(B) The alteration of higher-order protein structures without breaking peptide bonds.
(C) The enzymatic conversion of a standard amino acid into a metabolizable keto acid.
(D) The covalent bonding of a protein to a reducing carbohydrate during thermal steps.

46. Which of the following agents is primarily known to denature proteins by disrupting disulfide bonds?
(A) Dilute strong acids (e.g., hydrochloric acid)
(B) Reducing agents (e.g., mercaptoethanol)
(C) Soluble heavy metal salts (e.g., silver nitrate)
(D) Mild mechanical agitation or high shear forces

47. Match the functional property of proteins in List I with its corresponding food application in List II:
List I: Functional property of proteins
P. Emulsification
Q. Foaming
R. Gelation
S. Dough formation
List II: Food application
I. Wheat gluten in bread
II. Egg white in angel food cake
III. Casein in processed meat sausages
IV. Myosin and actin in surimi
(A) P-III, Q-II, R-IV, S-I
(B) P-II, Q-III, R-I, S-IV

Click Here to Buy book on Amazon

(C) P-IV, Q-I, R-II, S-III
(D) P-III, Q-IV, R-II, S-I

48. Which of the following statements correctly identifies a condition resulting in a positive nitrogen balance?
(A) A severe burn injury requiring intensive hospital care.
(B) Prolonged starvation and caloric restriction.
(C) Rapid growth during infancy and childhood.
(D) Advanced stages of untreated fever and infection.

49. Consider the following statements about proteolytic enzymes:
1. Pepsin functions optimally in the highly acidic environment of the stomach.
2. Trypsin cleaves peptide bonds adjacent to basic amino acids like lysine and arginine.
3. Aminopeptidase is an endopeptidase secreted by the pancreas.
4. Chymotrypsin prefers to cleave peptide bonds adjacent to aromatic amino acids.

Which of the statements given above are correct?
(A) 1, 2 and 3 only
(B) 1, 2 and 4 only
(C) 2, 3 and 4 only
(D) 1, 3 and 4 only

50. A food technologist is formulating a low-fat mayonnaise and needs to stabilize the oil-in-water emulsion. Which functional characteristic of egg yolk proteins makes them competent for this application?
(A) High buffering capacity and resistance to changes in acidic media
(B) Ability to form strong and highly stable covalent networks upon heating
(C) Amphiphilic nature allowing orientation at the oil-water interface
(D) High content of sulfur-containing amino acids preventing oxidation

51. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Thermal denaturation of proteins generally increases their susceptibility to enzymatic digestion in the human gastrointestinal tract.
Reason (R): Denaturation completely hydrolyzes the primary sequence of the protein, releasing free amino acids directly into the stomach.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

52. In the production of meringues, egg whites are mechanically beaten to create a foam. If excessive beating occurs, the foam collapses and liquid leaks out. What protein chemistry concept explains this application failure?
(A) Protein molecules revert to native globular structures due to loss of kinetic energy.
(B) Isoelectric point shifts drastically, causing the proteins to dissolve in the aqueous phase.
(C) Peptide bonds are mechanically sheared, destroying the amphiphilic nature of amino acids.
(D) Over-denaturation causes excessive coagulation and film rigidity, leading to water syneresis.

53. Consider the following statements regarding nitrogen balance:
Statement I: Nitrogen balance is mathematically defined as Nitrogen Intake minus Nitrogen Excretion (via urine, feces, and sweat).
Statement II: Healthy, weight-stable adults consuming an adequate diet typically maintain a state of nitrogen equilibrium.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

54. Proteins perform a vast array of critical functions in the human body. All of the following are primary physiological functions of proteins, except:
(A) Acting as highly specific biological catalysts (enzymes)
(B) Regulating fluid balance and osmotic pressure in blood
(C) Serving as the primary storage form of metabolic energy
(D) Providing structural support in tissues like collagen

NODIA

55. A clinical nutritionist is evaluating the 24-hour urine urea nitrogen of an athlete. The analysis reveals a significant negative nitrogen balance despite high dietary protein intake. What is the most plausible case-based explanation?
(A) Inadequate non-protein calories force the body to deaminate proteins for energy.
(B) The athlete is undergoing extremely rapid skeletal muscle hypertrophy during training.
(C) The athlete is consuming excessive daily calories from both carbohydrates and lipids.
(D) The athlete's primary dietary protein sources possess a perfect PDCAAS score of 1.0.

56. Identify the incorrect pair regarding the classification of lipids:
(A) Simple lipids – Triglycerides and waxes
(B) Conjugated/Compound lipids – Phospholipids and glycolipids
(C) Derived lipids – Sterols and fatty acids
(D) Sphingolipids – Polysaccharides bound to lipids

57. What is the physiological cause-and-effect of the secretion of hydrochloric acid (HCl) by gastric parietal cells on protein digestion?
(A) HCl directly cleaves peptide bonds of native proteins to release free amino acids.
(B) HCl lowers pH, activates pepsinogen to pepsin, and denatures dietary proteins.
(C) HCl neutralizes the acidic chyme to allow downstream pancreatic enzymes to function.
(D) HCl specifically activates lingual lipase to begin hydrolyzing complex lipoproteins.

58. Which of the following represents the most appropriate description of the role of phospholipids in food systems?
(A) They serve as the main source of essential omega-3 polyunsaturated fatty acids.
(B) They are the key components responsible for the crystallizing behavior of hard fats.
(C) They act as emulsifiers due to their hydrophilic heads and hydrophobic tails.
(D) They act as synthetic food-grade antioxidants to prevent hydrolytic rancidity.

59. Identify the incorrect statement regarding sterols in the diet and body:
(A) Cholesterol is a vital structural component of animal cell membranes.
(B) Ergosterol is a plant sterol that acts as a precursor for Vitamin D2.
(C) Plant sterols (phytosterols) can competitively inhibit the absorption of dietary cholesterol in the gut.
(D) Cholesterol yields 9 kcal/g of energy when oxidized in human cells.

60. Which of the following defines waxes in the context of lipid classification?
(A) Esters of fatty acids with long-chain monohydric alcohols.
(B) Esters of fatty acids with three-carbon glycerol molecules.
(C) Amides of fatty acids bound to complex sphingosine backbones.
(D) Polymeric chains composed of repeating organic isoprene units.

61. Which of the following fatty acids is a primary example of a polyunsaturated fatty acid (PUFA)?
(A) Stearic acid
(B) Linoleic acid
(C) Oleic acid
(D) Palmitic acid

62. Match the fatty acid in List I with its standard lipid nomenclature in List II:
List I: Fatty acid
P. Palmitic acid
Q. Oleic acid
R. Linoleic acid
S. Arachidonic acid
List II: Standard lipid nomenclature
I. C18:2 n-6
II. C20:4 n-6
III. C16:0
IV. C18:1 n-9
(A) P-III, Q-I, R-IV, S-II
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-IV, R-I, S-III

63. Which of the following statements correctly describes the formation of trans fats during food processing?
(A) Trans fats are formed during partial hydrogenation of vegetable oils, isomerizing cis double bonds to trans configuration.
(B) Trans fats are formed primarily during the complete hydrogenation of vegetable oils, turning them into solid saturated fats.
(C) Trans fats are produced when saturated dietary fats are subjected to extreme low

NODIA

temperatures, causing crystallization.
(D) Trans fats are synthesized by the enzymatic action of bacterial lipases during the natural ripening of common fruits.

64. Consider the following statements regarding dietary fats:
1. Saturated fatty acids have no double bonds in their hydrocarbon chain.
2. Monounsaturated fatty acids typically possess one trans double bond in nature.
3. High intake of trans fats is associated with elevated LDL and reduced HDL cholesterol levels.
4. Polyunsaturated fats are generally liquid at room temperature due to molecular bending at double bonds.

Which of the statements given above are correct?
(A) 1, 2 and 3 only
(B) 1, 3 and 4 only
(C) 2, 3 and 4 only
(D) 1, 2, 3 and 4

65. A Food Safety Officer is inspecting bakery shortening intended for commercial pastry production. The label claims "Zero Trans Fat." Which competency-based analytical finding would compel the officer to reject this claim?
(A) Gas chromatography showing high proportions of oleic and linoleic acids.
(B) Gas chromatography indicating ninety-five percent palmitic and stearic acids.
(C) Analytical testing confirming a measured iodine value of near zero.
(D) Infrared spectroscopy detecting a strong absorption peak at 966 cm^{-1}.

66. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA) exhibit potent anti-inflammatory properties in the human body.
Reason (R): They are Omega-3 fatty acids that compete with arachidonic acid for the cyclooxygenase enzyme, thereby reducing the synthesis of pro-inflammatory eicosanoids.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

67. An edible oil manufacturer is blending oils to achieve a product with high oxidative stability for deep frying, while maintaining a heart-healthy profile. Which conceptual application of fatty acid properties is most appropriate?
(A) Maximizing the alpha-linolenic acid content to protect the frying oil from high-temperature breakdown.
(B) Blending high-oleic oil with some saturated fat to resist oxidation without adding trans fats.
(C) Utilizing hundred percent pure fish oil to ensure maximum omega-3 delivery during high-heat frying.
(D) Using unrefined, cold-pressed flaxseed oil as the primary and most stable deep frying medium.

68. Consider the following statements regarding essential fatty acids:
Statement I: Linoleic acid (LA) is the primary parent fatty acid of the Omega-6 family.
Statement II: Alpha-linolenic acid (ALA) is the primary parent fatty acid of the Omega-3 family.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

69. All of the following are recognized dietary sources of Omega-3 fatty acids, except:
(A) Coconut oil
(B) Flaxseeds
(C) Walnuts
(D) Salmon

70. During an audit of a fast-food chain, an FSO finds that the frying oil has a high concentration of elaidic acid. The establishment claims they only use natural, unhydrogenated vegetable oils. What does the presence of elaidic acid indicate in this case?
(A) The frying oil is naturally rich in essential omega-3 polyunsaturated fats.
(B) The frying oil has been heavily adulterated

Downloaded from www.pdf.tube

with cheap and pure animal lard.
(C) The oil has undergone partial hydrogenation, which contradicts their claim.
(D) The oil is undergoing hydrolytic rancidity due to high moisture in food.

71. Identify the incorrect pair regarding fatty acids and their primary dietary classifications:
(A) Linoleic acid – Omega-3 PUFA
(B) Arachidonic acid – Omega-6 PUFA
(C) Eicosapentaenoic acid – Omega-3 PUFA
(D) Oleic acid – Omega-9 MUFA

72. What is the primary industrial cause-and-effect rationale for subjecting vegetable oils to partial hydrogenation?
(A) To increase the nutritional value of oil by generating essential fatty acids.
(B) To decrease the melting point, making the oil liquid and suitable for dressings.
(C) To naturally enrich the processed vegetable oil with fat-soluble vitamins A and D.
(D) To increase oxidative stability and produce semi-solid fats like margarine.

73. Arrange the following steps of lipid digestion and absorption in the correct sequence:
1. Emulsification of large fat droplets by bile salts
2. Formation of mixed micelles containing free fatty acids and monoglycerides
3. Hydrolysis of triglycerides by pancreatic lipase
4. Re-esterification into triglycerides and packaging into chylomicrons within enterocytes

(A) 1, 3, 2, 4
(B) 3, 1, 2, 4
(C) 1, 2, 3, 4
(D) 2, 1, 3, 4

74. Identify the incorrect statement regarding the physical properties of fatty acids:
(A) The melting point of fatty acids increases with increasing chain lengths.
(B) The introduction of cis double bonds significantly lowers the melting point.
(C) Trans fatty acids have lower melting points than corresponding cis isomers.
(D) Short-chain fatty acids (e.g., butyric acid) are liquid at room temperature.

75. Which of the following defines essential fatty acids?
(A) Fatty acids that provide exactly nine kilocalories of metabolic energy when fully oxidized.
(B) Saturated fatty acids strictly required for the structural integrity of complex brain tissues.
(C) Any fatty acid containing a trans double configuration crucial for cellular receptor signaling.
(D) Polyunsaturated fatty acids that the body cannot synthesize and must obtain from diet.

76. Which enzyme is responsible for the majority of dietary triglyceride hydrolysis in the human digestive system?
(A) Pancreatic lipase
(B) Gastric lipase
(C) Lipoprotein lipase
(D) Hormone-sensitive lipase

77. Match the lipoproteins in List I with their primary physiological function in List II:
List I: Lipoproteins
P. Chylomicrons
Q. VLDL
R. LDL
S. HDL
List II: Primary physiological function
I. Transport endogenous triglycerides from liver to peripheral tissues
II. Reverse cholesterol transport from tissues back to the liver
III. Transport dietary lipids from the intestine to peripheral tissues
IV. Transport cholesterol to peripheral tissues
(A) P-I, Q-III, R-IV, S-II
(B) P-III, Q-I, R-IV, S-II
(C) P-III, Q-IV, R-I, S-II
(D) P-IV, Q-I, R-III, S-II

NODIA

78. Which of the following statements correctly explains the significance of micelle formation in the small intestine?
(A) Micelles permanently encapsulate hydrophobic lipids for final excretion in feces.
(B) Micelles solubilize digestion products to transport them to the enterocytes.
(C) Micelles directly transport intact dietary triglycerides into the hepatic portal vein.
(D) Micelles act as specific biological enzymes

that catalyze cholesterol ester breakdown.

79. Consider the following statements regarding fat metabolism:
1. Lipolysis is the breakdown of stored triglycerides into glycerol and free fatty acids.
2. Beta-oxidation occurs primarily in the cytoplasm of the cell.
3. The end product of each cycle of beta-oxidation is a two-carbon unit called Acetyl-CoA.
4. Ketogenesis is stimulated when carbohydrate availability is extremely low.

Which of the statements given above are correct?
(A) 1, 2 and 3 only
(B) 1, 3 and 4 only
(C) 2, 3 and 4 only
(D) 1, 2, 3 and 4

80. A Food Safety Officer collects a sample of refined sunflower oil from a commercial kitchen that emits a harsh, paint-like odor. Which competency-based analytical test is most appropriate to confirm the extent of primary oxidative degradation in this sample?
(A) Saponification Value
(B) Free Fatty Acid (FFA) content
(C) Peroxide Value
(D) Iodine Value

81. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The addition of Butylated Hydroxytoluene (BHT) to lipid-rich foods delays the onset of oxidative rancidity.
Reason (R): BHT acts as a primary antioxidant by donating a hydrogen atom to free radicals, thereby terminating the radical chain reaction.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

82. In the dairy industry, raw milk must be promptly pasteurized to prevent off-flavours often described as "soapy" or "rancid". Which conceptual application of food science explains this prevention?
(A) Pasteurization neutralizes the highly reactive free radicals present in raw milk.
(B) Heat drives off dissolved oxygen, stopping auto-oxidation of unsaturated fats.
(C) Heat inactivates endogenous milk lipases, preventing hydrolytic rancidity.
(D) Heating denatures milk proteins which otherwise bind to lipids causing spoilage.

83. Consider the following statements regarding the energy value of macronutrients:
Statement I: The physiological fuel value (Atwater factor) for dietary fats is approximately 9 kcal/g.
Statement II: Fats yield more than twice the energy per gram compared to carbohydrates and proteins due to their higher ratio of carbon and hydrogen relative to oxygen.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

84. All of the following factors accelerate the rate of oxidative rancidity in fats and oils, except:
(A) Exposure to ultraviolet (UV) light
(B) Presence of trace transition metals (e.g., Copper and Iron)
(C) High degree of unsaturation in the fatty acid chains
(D) Storage under a strict nitrogen atmosphere

85. A batch of deep-fried potato chips is rejected by quality control due to a distinct "soapy" off-flavour, despite the frying oil having a low Peroxide Value. The chips were fried in palm oil and had high residual moisture. What is the most likely case-based explanation?
(A) High moisture catalyzed hydrolytic rancidity, releasing fatty acids.
(B) The frying oil underwent severe, rapid and uncontrolled auto-oxidation.
(C) The palm oil was heavily and illegally adulterated with toxic mineral oil.
(D) The starch within the potato matrix retrograded completely during frying.

Click Here to Buy book on Amazon

86. Identify the incorrect pair regarding the Atwater physiological fuel values of macronutrients:
(A) Carbohydrates – 4 kcal/g
(B) Proteins – 4 kcal/g
(C) Dietary Fibre – 7 kcal/g
(D) Fats – 9 kcal/g

87. What is the cause-and-effect relationship of moisture introduced into hot frying oil during food processing?
(A) It hydrolyzes triglycerides into fatty acids, accelerating rancidity and lowering the smoke point.
(B) It acts as an effective natural antioxidant, thereby prolonging the overall frying life of the oil.
(C) It polymerizes the oil, increasing its dynamic viscosity and improving the overall heat transfer rate.
(D) It rapidly saturates double bonds of lipids, converting liquid vegetable oil into solid hard fats.

88. Which of the following represents the most appropriate explanation of the "protein-sparing action" of carbohydrates and fats?
(A) Adequate intake of carbohydrates and fats ensures excess proteins are stored as adipose tissue.
(B) High fat diets completely prevent the enzymatic digestion of proteins, sparing them in the gut.
(C) Carbohydrates physically bind to circulating proteins in the blood, preventing their breakdown.
(D) They satisfy energy demands, allowing proteins to be used for tissue repair and synthesis.

89. Identify the incorrect statement regarding lipid transport mechanisms:
(A) Chylomicrons are formed in the enterocytes of the small intestine.
(B) VLDL primarily transports dietary cholesterol absorbed directly from the stomach.
(C) LDL is colloquially referred to as "bad cholesterol" because it deposits cholesterol in the arterial walls.
(D) HDL retrieves excess cholesterol from tissues and returns it to the liver.

NODIA

90. Which of the following defines the Peroxide Value of a fat or oil?
(A) A measure of the average molecular weight of all fatty acids present in the lipid.
(B) The number of milligrams of KOH required to fully saponify 1 gram of the test fat.
(C) An indicator of primary oxidation, measuring the concentration of hydroperoxides.
(D) A precise measure of the degree of unsaturation based on halogen absorption capacity.

91. Which central metabolic intermediate acts as the crossroad connecting the metabolism of carbohydrates, proteins, and fats?
(A) Pyruvate
(B) Oxaloacetate
(C) Alpha-ketoglutarate
(D) Acetyl-CoA

92. Match the macronutrient in List I with its approximate Thermic Effect of Food (TEF) percentage in List II:
List I: Macronutrient
P. Proteins
Q. Carbohydrates
R. Fats
S. Mixed Diet
List II: Approximate Thermic Effect of Food (TEF) percentage
I. 0 - 3%
II. 5 - 10%
III. 20 - 30%
IV. ~ 10%
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-III, R-I, S-IV
(C) P-III, Q-I, R-II, S-IV
(D) P-I, Q-II, R-III, S-IV

93. Which of the following statements correctly describes the interrelationship of macronutrient metabolism during excess caloric intake?
(A) Excess dietary protein is strictly excreted and cannot ever contribute to fat stores.
(B) Carbohydrates can be converted to fatty acids via lipogenesis using Acetyl-CoA.
(C) Fatty acids can be directly and easily converted into glucose through reverse glycolysis.
(D) Certain amino acids can be readily converted into essential fatty acids in the liver.

94. Consider the following statements regarding gluconeogenesis:
1. Glucogenic amino acids can serve as substrates for glucose production.
2. The glycerol backbone of triglycerides can be converted to glucose.
3. Even-chain fatty acids are major substrates for net glucose synthesis in humans.
4. Gluconeogenesis becomes crucial during prolonged fasting or highly carb-restricted diets.

Which of the statements given above are correct?
(A) 1, 2 and 4 only
(B) 2, 3 and 4 only
(C) 1, 3 and 4 only
(D) 1, 2, 3 and 4

95. A nutritionist is designing a Ready-to-Use Therapeutic Food (RUTF) for severe acute malnutrition. To maximize energy density while maintaining acceptable osmolality and minimizing renal solute load, which macronutrient should be utilized as the predominant energy source?
(A) Dietary fats
(B) Simple sugars
(C) Complex proteins
(D) Soluble fibre

96. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): During severe starvation or uncontrolled diabetes, the body produces high levels of ketone bodies.
Reason (R): Depletion of oxaloacetate for gluconeogenesis diverts the accumulating Acetyl-CoA from beta-oxidation into the ketogenesis pathway.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

97. After 72 hours of complete fasting, the human brain undergoes a significant metabolic shift to ensure survival. Which conceptual application of metabolic interrelationships correctly describes this shift?
(A) The brain begins to actively beta-oxidize circulating free fatty acids directly for its energy.
(B) The brain completely ceases its physiological demand for energy to preserve cellular structure.
(C) The brain shifts entirely to cellular anaerobic glycolysis, producing large amounts of lactate.
(D) The brain adapts to use ketone bodies as its primary fuel source, sparing muscle protein.

98. Consider the following statements:
Statement I: Plant-based dietary sources such as nuts, seeds, and avocados are generally rich in unsaturated fats and devoid of cholesterol.
Statement II: Animal-based dietary sources such as butter, cheese, and fatty meats are primary sources of dietary cholesterol and saturated fats.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

99. Proteins perform a vast array of critical functions in the human body. All of the following are recognized physiological functions of cholesterol in the human body, except:
(A) Serving as an essential biochemical precursor for the synthesis of bile acids.
(B) Serving as the primary substrate for oxidative ATP generation in cardiac muscle.
(C) Serving as a precursor for steroid hormones like testosterone and estrogen.
(D) Serving as a vital structural component of mammalian cell membrane fluidity.

100. A clinical dietician is evaluating the dietary pattern of a strict vegan. While the diet meets all caloric needs, the dietician expresses concern regarding potential deficiencies in certain essential nutrients natively found in animal products. Which combination of nutrients is most likely at risk in this case?
(A) Vitamin C, potassium, and beneficial soluble dietary fibre
(B) Carbohydrates, metabolic enzymes, and essential potassium
(C) Folate, biological selenium, and fat-soluble

Downloaded from www.pdf.tube

Vitamin E
(D) Vitamin B12, complete protein, and long-chain Omega-3s

101. Identify the incorrect pair regarding the typical limiting amino acid in common food sources:
(A) Egg – Valine
(B) Wheat – Lysine
(C) Legumes – Methionine
(D) Maize – Tryptophan

102. What is the physiological cause-and-effect of consuming dietary protein significantly in excess of the body's synthetic and energy requirements?
(A) The excess amino acids are stored completely intact in specialized, non-metabolic muscle vacuoles.
(B) The excess protein is excreted directly and rapidly in the urine, causing clinical proteinuria.
(C) Amino acids are deaminated, increasing kidney urea burden, with carbon skeletons stored as fat.
(D) It directly triggers the immediate synthesis of new muscle fibers, regardless of physical activity.

103. Arrange the following energy sources in the sequence they are predominantly depleted by the human body during prolonged fasting/ starvation:
1. Adipose tissue triglycerides
2. Exogenous (dietary) glucose
3. Muscle proteins
4. Liver glycogen

(A) 2, 4, 1, 3
(B) 2, 1, 4, 3
(C) 4, 2, 1, 3
(D) 2, 4, 3, 1

104. Identify the incorrect statement regarding lipogenesis:
(A) It occurs predominantly in the liver and adipose tissue.
(B) The pathway utilizes NADPH as a reducing agent.
(C) It involves the sequential addition of two-carbon units derived from Acetyl-CoA.
(D) It is strongly stimulated by the hormone glucagon during periods of fasting.

105. Which of the following defines the Nutrient Density of a food?
(A) The physical weight of a given food item measured per unit of its total volume.
(B) The ratio of essential nutrients provided by a food relative to its calories.
(C) The total percentage of all major macronutrients present in a specific food matrix.
(D) The rate at which a specific digested food releases glucose into the bloodstream.

106. Which nutritional disorder is primarily characterized by severe muscle wasting and loss of subcutaneous fat due to a combined deficit of both total energy (calories) and protein?
(A) Kwashiorkor
(B) Scurvy
(C) Marasmus
(D) Beriberi

107. Match the macronutrient imbalance in List I with its associated physiological consequence or disorder in List II:
List I: Macronutrient imbalance
P. Chronic excess of saturated fats and trans fats
Q. Severe protein deficiency with adequate calories
R. Excess intake of refined carbohydrates
S. Deficiency of essential fatty acids
List II: Associated physiological consequence or disorder
I. Kwashiorkor
II. Cardiovascular disease (Atherosclerosis)
III. Scaly dermatitis and poor wound healing
IV. Insulin resistance and Metabolic Syndrome
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-I, R-II, S-III
(C) P-II, Q-IV, R-I, S-III
(D) P-II, Q-I, R-IV, S-III

108. Which of the following statements correctly highlights the role of dietary fats beyond energy provision?
(A) Dietary fats are necessary for absorbing and transporting fat-soluble vitamins.
(B) Dietary fats act as the primary enzymatic catalysts within the hepatic Krebs cycle.
(C) Dietary fats buffer stomach acid to actively prevent the formation of ulcers.
(D) Dietary fats exclusively provide the substrate for high-intensity muscle action.

NODIA

109. Consider the following statements regarding the Maillard browning reaction in foods:
1. It requires the presence of a reducing sugar.
2. It requires a free amino group, typically from a protein or amino acid.
3. It is an enzymatic process catalyzed by polyphenol oxidase.
4. It is accelerated at high temperatures and low moisture conditions.

Which of the statements given above are correct?
(A) 1, 2 and 3 only
(B) 1, 2 and 4 only
(C) 2, 3 and 4 only
(D) 1, 3 and 4 only

110. A Food Safety Officer is auditing a commercial beverage claiming to be "High Protein." Based on competency in macronutrient functional properties, which test would most accurately verify the total protein content of the beverage?
(A) Benedict's test
(B) Kjeldahl method
(C) Soxhlet extraction
(D) Iodine test

111. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): When raw starch granules are heated in excess water, they undergo gelatinization, resulting in a dramatic increase in viscosity.
Reason (R): Heat energy disrupts the intermolecular hydrogen bonds within the starch granule, allowing water to penetrate, swell the granule, and leach out amylose.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

112. A bakery has received complaints that its freshly baked bread becomes hard, stale, and crumbly within two days, despite proper packaging. Which conceptual application of carbohydrate chemistry explains this rapid deterioration?
(A) The chemical Maillard reaction continuing slowly and steadily at room temperature.
(B) Extensive dextrinization of the crust actively drawing moisture from the crumb.
(C) Retrogradation, where starch chains realign and recrystallize, expelling water.
(D) Continuous enzymatic hydrolysis of starch molecules by residual yeast amylases.

113. Consider the following statements regarding non-enzymating browning:
Statement I: Caramelization involves the thermal degradation of sugars in the absence of amino acids.
Statement II: The Maillard reaction requires both a reducing sugar and an amino compound to produce melanoidins.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

114. All of the following are essential functional properties of carbohydrates in food processing, except:
(A) Sweetening and flavor enhancement
(B) Gelation and thickening (e.g., starch and pectin)
(C) Emulsification of oil and water phases
(D) Cryoprotection and depressing the freezing point (e.g., sugars in ice cream)

115. A food scientist is developing a gluten-free bread for patients with celiac disease. Since gluten (a protein) is removed, the dough lacks elasticity and gas-holding capacity. What is the most common case-based formulation strategy to mimic the functional properties of gluten in this product?
(A) Adding excessive amounts of industrial trans fats to trap air bubbles.
(B) Incorporating hydrocolloids to provide a viscoelastic network.
(C) Substituting wheat flour entirely with highly pure crystalline sucrose.
(D) Using highly denatured whey protein isolate to form a rigid lattice.

116. Identify the incorrect pair regarding macronutrient functional properties in specific foods:

Click Here to Buy book on Amazon

(A) Coagulation of protein – Thermal firming of boiled eggs
(B) Gelatinization of starch – Thickening of hot gravies
(C) Syneresis – Spontaneous weeping of liquid from set gel
(D) Dextrinization – Formation of stable oil-in-water emulsion

117. What is the cause-and-effect relationship resulting in the syneresis of a starch-based gel during prolonged refrigerated storage?
(A) Amylose molecules re-associate tightly (retrogradation), squeezing out the trapped water matrix.
(B) The cold temperature halts enzyme activity, causing water to separate.
(C) The gel absorbs excess moisture from the refrigerator atmosphere, leading to liquid pooling.
(D) Refrigeration causes the starch granules to unexpectedly undergo secondary gelatinization.

118. Which of the following best describes the functional mechanism of mono- and diglycerides when added to baked goods?
(A) They act as highly intense artificial sweeteners in modern low-calorie foods.
(B) They serve strictly as synthetic chemical antioxidants to prevent fat oxidation.
(C) They function as emulsifiers and complex with amylose to retard staling.
(D) They induce extreme cross-linking of gluten proteins, making dough highly rigid.

119. Identify the incorrect statement comparing Marasmus and Kwashiorkor:
(A) Fatty liver (hepatomegaly) is a common clinical feature in Marasmus, but rarely seen in Kwashiorkor.
(B) Edema is a characteristic symptom of Kwashiorkor but is typically absent in Marasmus.
(C) Marasmus results from a severe deficit of total calories, whereas Kwashiorkor is primarily a protein deficit.
(D) Both conditions are forms of Protein-Energy Malnutrition (PEM).

120. Which of the following defines dextrinization in food processing?
(A) The enzymatic breakdown of dietary proteins into smaller peptones and proteoses.
(B) The chemical process of hardening liquid vegetable oils into solid fats via hydrogen.
(C) The biochemical conversion of glucose into lactic acid by active fermentation.
(D) The breakdown of starch into smaller dextrins upon the application of dry heat.

121. What is the typical macronutrient distribution ratio designed to induce physiological ketosis in a classic standard ketogenic diet?
(A) 40% Fat, 30% Protein, 30% Carbohydrate
(B) 70-80% Fat, 10-20% Protein, 5-10% Carbohydrate
(C) 10-15% Fat, 20-30% Protein, 55-65% Carbohydrate
(D) 50% Protein, 30% Carbohydrate, 20% Fat

122. Match the recent dietary trend in List I with its primary macronutrient modification characteristic in List II:
List I: Recent dietary trend
P. Ketogenic diet
Q. Paleolithic diet
R. Mediterranean diet
S. DASH diet
List II: Primary macronutrient modification characteristic
I. Emphasizes MUFA (olive oil), omega-3s, and unrefined carbohydrates
II. Extremely low carbohydrate, high fat to induce ketone production
III. High protein, excludes dairy, grains, and refined sugars
IV. Low sodium, rich in fruits, vegetables, and low-fat dairy
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-I, R-III, S-IV
(C) P-II, Q-III, R-I, S-IV
(D) P-IV, Q-III, R-II, S-I

123. Which of the following statements correctly identifies a physiological impact of sustaining a very high-protein diet without adequate hydration?
(A) It significantly lowers the basal metabolic rate and reduces systemic thyroid hormone output.
(B) It induces severe systemic hypoglycemia by directly inhibiting the biological action of glucagon.
(C) It directly causes the immediate and irreversible pathological calcification of

Downloaded from www.pdf.tube

arterial walls.
(D) It can cause increased renal solute load and dehydration from excreting excess urea.

124. Consider the following statements regarding modern diet modifications:
1. Low-carb diets intentionally deplete hepatic and skeletal muscle glycogen stores.
2. Fat-modified diets often recommend replacing saturated fats with polyunsaturated and monounsaturated fats.
3. High-protein diets increase the thermic effect of food compared to high-fat diets.
4. The ketogenic diet relies primarily on glycolysis for brain energy metabolism.

Which of the statements given above are correct?
(A) 1, 2 and 3 only
(B) 1, 3 and 4 only
(C) 2, 3 and 4 only
(D) 1, 2, 3 and 4

125. A Food Safety Officer is analyzing the label of a product marketed as "Sugar-Free." The ingredients list includes maltitol and sorbitol. Based on competency in assessing nutritional labels, how should the officer classify these ingredients?
(A) Non-caloric artificial sweeteners that do not impact circulating blood glucose levels.
(B) Sugar alcohols providing fewer calories than sucrose with a lower glycaemic effect.
(C) High-intensity natural sweeteners that provide absolutely zero caloric value to the body.
(D) Indigestible dietary fibres that yield no metabolizable energy during human digestion.

126. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Resistant starch is increasingly incorporated into modern functional foods as a prebiotic.
Reason (R): It escapes digestion by human enzymes in the small intestine and is fermented by beneficial microflora in the large intestine, producing short-chain fatty acids.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

127. A reduced-fat ice cream is formulated using a microparticulated whey protein product (e.g., Simplesse) as a fat replacer. What conceptual property allows this protein to mimic fat?
(A) Its microparticulated spherical structure rolls on the tongue, mimicking fat mouthfeel.
(B) It undergoes chemical esterification with long-chain fatty acids to form synthetic triglycerides.
(C) It is heavily cross-linked with indigestible dietary carbohydrates to form a rigid water-binding gel.
(D) It provides nine kilocalories per gram of energy, perfectly mimicking the caloric density of dairy fat.

128. Consider the following statements regarding fat replacers:
Statement I: Carbohydrate-based fat replacers like maltodextrins and gums provide approximately 0 kcal/g.
Statement II: Olestra is a lipid-based fat substitute composed of sucrose esterified with fatty acids, which cannot be digested by human enzymes, yielding 0 kcal/g.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

129. All of the following are typically encouraged in a strict, classic ketogenic diet, except:
(A) Heavy cream and butter
(B) Non-starchy leafy green vegetables
(C) Olive oil and avocados
(D) Legumes and whole grains

130. A consumer files a complaint regarding a commercial "sugar-free" candy, reporting severe osmotic diarrhea and gastrointestinal distress after consuming a large quantity. What is the most scientifically sound case-based explanation for this event?
(A) The candy was heavily contaminated with

NODIA

a highly potent strain of entero-toxigenic pathogenic bacteria.
(B) The artificial sweetener aspartame underwent extreme thermal degradation, forming toxic methanol levels.
(C) Incompletely absorbed sugar alcohols exerted an osmotic effect in the colon, causing diarrhea.
(D) The lack of sugar caused an acute hypoglycemic shock, which was misinterpreted as gastrointestinal distress.

131. Identify the incorrect pair regarding alternative sweeteners and their energy yield:
(A) Aspartame – Provides ~4 kcal/g but is intensely sweet, so very little is used.
(B) Xylitol – Provides 0 kcal/g and is completely inert in the human body.
(C) Sucralose – Non-caloric because it is largely unabsorbed and not metabolized.
(D) Saccharin – Non-caloric and excreted unchanged in the urine.

132. What is the physiological cause-and-effect of severely restricting dietary carbohydrates (less than 50g per day) for an extended period?
(A) Insulin levels remain constantly and heavily elevated, promoting extreme and continuous lipogenesis.
(B) The human body immediately loses its native biochemical ability to synthesize essential amino acids.
(C) Red blood cells completely shift to metabolizing fatty acids directly for their physiological energy.
(D) The liver converts fatty acids into ketone bodies to supply energy to the central nervous system.

133. Arrange the following phases of the Maillard reaction in their correct sequential order during food processing:
1. Formation of Amadori or Heyns rearrangement products
2. Condensation of a reducing sugar with a free amino group to form a Schiff base
3. Polymerization of highly reactive intermediates to form dark brown melanoidins
4. Degradation of Amadori products into reactive dicarbonyl compounds and reductones

(A) 2, 1, 4, 3
(B) 1, 2, 3, 4
(C) 2, 4, 1, 3
(D) 4, 2, 1, 3

134. Identify the incorrect statement regarding intermittent fasting diets and macronutrient metabolism:
(A) During the fasting window, insulin levels drop, facilitating the mobilization of fatty acids from body fat tissues.
(B) Glycogenolysis in the liver provides the primary, essential source of blood glucose during the early hours of fasting.
(C) It guarantees weight loss regardless of total caloric intake or food composition during the eating window.
(D) Extended fasting windows can lead to a mild, physiological state of ketosis with minimal muscle protein degradation.

135. Which of the following accurately defines "fat mimetics" in food technology?
(A) Carbohydrate- or protein-based fat substitutes that mimic fat properties with fewer calories.
(B) Synthetic lipid-based compounds that provide nine kilocalories per gram without raising blood cholesterol.
(C) Active chemical formulations that specifically block the action of pancreatic lipase in the gut.
(D) Food-grade emulsifiers that physically convert saturated fats into polyunsaturated fats during cooking.

136. What is the accepted safe minimum requirement of protein for a healthy adult, according to standard recommended dietary guidelines?
(A) 0.5 g per kg of body weight per day
(B) 1.5 to 2.0 g per kg of body weight per day
(C) 2.5 g per kg of body weight per day
(D) 0.83 to 1.0 g per kg of body weight per day

137. Match the specific vitamin or mineral cofactor in List I with the macronutrient metabolic pathway it primarily assists in List II:
List I: Specific vitamin or mineral cofactor
P. Thiamine (Vitamin B1)
Q. Pyridoxal phosphate (Vitamin B6)
R. Biotin (Vitamin B7)
S. Pantothenic acid (Vitamin B5)
List II: Macronutrient metabolic pathway
I. Component of Coenzyme A in lipid and carb

Click Here to Buy book on Amazon

metabolism
II. Carboxylation reactions (e.g., Acetyl-CoA carboxylase in lipogenesis)
III. Transamination of amino acids
IV. Oxidative decarboxylation (e.g., Pyruvate to Acetyl-CoA)
(A) P-III, Q-IV, R-I, S-II
(B) P-IV, Q-III, R-II, S-I
(C) P-IV, Q-I, R-II, S-III
(D) P-I, Q-II, R-III, S-IV

138. Which of the following statements is correct regarding the general conversion factor used to calculate crude protein content from total nitrogen in most mixed foods?
(A) Total Nitrogen × 5.95
(B) Total Nitrogen × 6.38
(C) Total Nitrogen × 6.25
(D) Total Nitrogen × 5.70

139. Consider the following statements about dietary fibre:
1. Soluble fibres, like pectin and beta-glucan, dissolve in water to form viscous gels.
2. Insoluble fibres, like cellulose, primarily increase fecal bulk and promote laxation.
3. Pectin is predominantly classified as an insoluble dietary fibre.
4. Cellulose is completely fermented by human gut bacteria into short-chain fatty acids.

Which of the statements given above are correct?
(A) 1 and 2 only
(B) 1, 2 and 3 only
(C) 3 and 4 only
(D) 1, 3 and 4 only

140. A Food Safety Officer evaluates a nutrition label of a packaged food containing 10g of carbohydrates, 5g of protein, and 2g of fat per serving. Using standard Atwater factors, what is the exact calculated metabolizable energy of one serving?
(A) 78 kcal
(B) 68 kcal
(C) 85 kcal
(D) 95 kcal

141. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The Biological Value (BV) of a whole egg is conventionally considered to be 100.
Reason (R): The protein in a whole egg contains all essential amino acids in amounts and proportions that exactly match the requirements for human protein synthesis.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

142. A commercial meat processor is experiencing rapid oxidative rancidity in frozen pork sausages. To effectively mitigate this without using synthetic additives, which of the following conceptual interventions should be applied?
(A) Exposing the sausages to UV light before freezing to sterilize surface fat.
(B) Incorporating rosemary extract containing natural phenolic antioxidants.
(C) Adding high amounts of trace copper salts to bind reactive free radicals.
(D) Increasing the overall proportion of polyunsaturated fats in sausage recipe.

143. Consider the following statements regarding lipid oxidation:
Statement I: Polyunsaturated fats (PUFAs) are significantly more susceptible to oxidative rancidity than monounsaturated fats (MUFAs).
Statement II: The presence of multiple methylene-interrupted double bonds decreases the bond dissociation energy of the allylic hydrogen, increasing reactivity with oxygen.
Which of the above statement(s) is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

144. All of the following are critical biological functions of dietary carbohydrates in humans, except:
(A) Preventing the excessive breakdown of body proteins for energy.
(B) Preventing the severe accumulation of ketone bodies (anti-ketogenic effect).
(C) Serving as the primary precursor for the synthesis of essential amino acids.

(D) Providing the structural backbone (ribose/deoxyribose) for nucleic acids.

145. A food company formulates an infant weaning food based purely on soy protein isolate. When evaluating the formula for safety and efficacy, the quality control team notes a PDCAAS score of roughly 0.9. What case-based conclusion must be drawn to ensure it meets infant requirements?
(A) The formula is highly toxic to infant digestive systems and must be discarded immediately.
(B) The formula has an excess of lysine which inhibits the absorption of other amino acids.
(C) Soy protein cannot be biologically digested by infants, rendering the PDCAAS completely invalid.
(D) The formula is slightly low in methionine, requiring supplementation to reach 1.0.

146. Identify the incorrect pair regarding digestive enzymes and their optimal pH environment:
(A) Salivary amylase – Neutral pH (~6.8)
(B) Pepsin – Highly acidic pH (~1.5 to 2.0)
(C) Pancreatic lipase – Highly acidic pH (~2.0)
(D) Trypsin – Slightly alkaline pH (~7.5 to 8.5)

147. What is the cause-and-effect relationship of substituting naturally liquid vegetable oils with heavily hydrogenated fats in processed food formulations?
(A) It significantly increases the essential fatty acid content, greatly improving the overall nutritional lipid profile.
(B) It increases solid fat content and shelf-life, but generates trans fats linked to cardiovascular risk.
(C) It lowers the melting point of the fat, making the processed product highly unstable at typical room temperatures.
(D) It causes the immediate and complete saponification of the fat matrix, creating a highly undesirable soapy texture.

148. Which of the following is the most crucial intrinsic food factor that directly decreases the Glycaemic Index (GI) of a carbohydrate-rich food?
(A) A high proportional concentration of highly branched amylopectin starch molecules.
(B) Extensive and highly intensive mechanical milling of grains into extremely fine flour.
(C) The complete and total enzymatic removal of all dietary fats from the complex food matrix.
(D) The physical entrapment of starch within intact cell structures like whole grains.

149. Identify the incorrect statement regarding the process of lipid absorption:
(A) Chylomicrons are expelled from the enterocyte into the capillaries of the portal vein.
(B) Short-chain and medium-chain fatty acids can be absorbed directly into the portal blood without micelle formation.
(C) Long-chain fatty acids are re-esterified into triglycerides within the intestinal enterocytes.
(D) Bile salts, essential for micelle formation, are largely reabsorbed in the terminal ileum.

150. Which of the following defines the Saponification Number of a fat or oil?
(A) The number of milligrams of KOH required to neutralize the free fatty acids in exactly 1 gram of the fat.
(B) The percentage of elemental iodine absorbed by the fat matrix, directly indicating the total degree of unsaturation.
(C) The milligrams of KOH required to saponify 1 gram of fat, indicating fatty acid molecular weight.
(D) The specific temperature point at which a heated fat or oil continuously emits a visible wisp of bluish smoke.

www.nodia.in

Downloaded from www.pdf.tube

ANSWERS

1. (D) Carbohydrates 55-60%, Proteins 10-15%, Fats 20-30%
A balanced diet for a healthy adult typically derives the majority of its daily energy requirement from carbohydrates, representing over half of the total caloric intake. Fats provide a concentrated energy source and should contribute a moderate percentage, while proteins serve essential structural and metabolic roles, requiring a smaller but significant proportion of the daily energy intake.

2. (C) P-II, Q-IV, R-III, S-I
Galactose is a simple monosaccharide containing a single sugar unit. Maltose is a disaccharide formed by two glucose units linked together. Glycogen represents a highly branched polysaccharide utilized for energy storage in animals. Fructooligosaccharides are short-chain polymers of fructose molecules classified as oligosaccharides, which often serve prebiotic functions in the human digestive system.

3. (B) They are nutrients required in large quantities to provide energy, structural components, and vital substrates.
Macronutrients constitute the primary dietary components that the human body requires in large daily quantities, typically measured in grams. They undergo metabolic oxidation to yield energy, supply building blocks for cellular growth and tissue repair, and provide essential substrates necessary for the synthesis of functional molecules and structural components throughout the physiological system.

4. (B) 2, 3 and 4 only
Cellulose contains beta-1,4-glycosidic bonds that resist human enzymatic hydrolysis, while starch consists of alpha-linked glucose units. Glycogen is a highly branched animal polysaccharide containing both alpha-1,4 and alpha-1,6 linkages, allowing rapid mobilization. Inulin is a storage polysaccharide found in various plants, composed primarily of fructose units and classified as a fructan.

5. (A) Starch
Iodine reacts specifically with the helical structure of amylose present in starch, forming a deeply colored coordination complex. This characteristic chemical reaction is widely utilized in food analysis to detect the unauthorized addition of starch as a thickening agent or adulterant in dairy products, where it artificially elevates the perceived viscosity and solids content.

NODIA

6. (A) Both A and R are true and R is the correct explanation of A.
The human digestive tract is unable to derive metabolizable energy from cellulose because it lacks the specific beta-glucosidase enzymes required to cleave the beta-1,4-glycosidic bonds. Consequently, these polysaccharide chains pass through the upper gastrointestinal tract undigested, acting as dietary fibre rather than contributing to the metabolic energy pool of the human body.

7. (A) High-amylose corn starch
High-amylose corn starch contains a high proportion of linear glucose chains that are tightly packed and highly resistant to rapid enzymatic hydrolysis. This structural property ensures a slow, gradual release of glucose into the bloodstream, which supports sustained glycogen synthesis and prevents rapid spikes and subsequent crashes in blood glucose levels during prolonged physical exertion.

8. (B) Both Statement I and Statement II are incorrect.
Amylose is actually the linear, unbranched polymer of starch that readily aligns to form crystalline, retrograded structures upon cooling. Conversely, amylopectin is the highly branched component of starch that disrupts close molecular alignment and is primarily responsible for the characteristic viscous, gel-like consistency observed when starch is heated in an aqueous environment.

9. (B) Sucrose
Reducing sugars possess free aldehyde or ketone groups capable of acting as reducing agents. Monosaccharides like glucose, and disaccharides like lactose and maltose, have hemiacetal groups

that can open to expose these reactive carbonyl groups. Sucrose is a non-reducing sugar because its constituent glucose and fructose units are linked through their respective anomeric carbons.

10. (C) Invert sugar syrup
Invert sugar syrup is produced by the chemical or enzymatic hydrolysis of sucrose into its constituent monosaccharides, glucose and fructose. This process yields an equimolar mixture that resists crystallization and possesses a high level of sweetness, making it a common adulterant used to illegally substitute or dilute natural honey, which naturally shares a similar monosaccharide composition.

11. (D) Cellobiose – Glucose and Fructose
Cellobiose is a disaccharide obtained from the partial hydrolysis of cellulose and is composed of two glucose molecules linked by a beta-1,4-glycosidic bond. This distinguishes it from other common disaccharides, such as sucrose, which contains glucose and fructose, and maltose, which is composed of two alpha-linked glucose units, making the pairing with fructose incorrect.

12. (A) Gel formation delaying glucose absorption and lowering blood cholesterol
Soluble dietary fibre hydrates in the gastrointestinal tract to form a highly viscous gel-like matrix. This physical barrier slows gastric emptying and delays the diffusion of glucose toward the intestinal mucosa, stabilizing postprandial blood sugar. Additionally, it binds bile acids, forcing the liver to utilize endogenous cholesterol for new bile acid synthesis, thereby lowering blood cholesterol.

13. (A) 2, 3, 1, 4
Fructose exhibits the highest relative sweetness among natural sugars, followed closely by sucrose, which serves as the standard reference sugar. Glucose possesses a lower sweetening power compared to sucrose, while lactose is characterized by a very low relative sweetness, making it the least sweet among these common mono- and disaccharides in food systems.

14. (B) It has fewer alpha-1,6 branching points compared to plant amylopectin.
Glycogen is characterized by a highly branched structure containing significantly more frequent alpha-1,6 glycosidic branching points than plant amylopectin. This high density of branch points creates a large number of non-reducing ends, which allows glycogen phosphorylase enzymes to rapidly mobilize and release glucose molecules simultaneously during periods of increased metabolic energy demand.

15. (A) A covalent bond linking a carbohydrate to another group, which may or may not be a carbohydrate.
A glycosidic bond is a specific type of covalent linkage formed between the hemiacetal or hemiketal group of a saccharide and the hydroxyl group of another molecule. This partner molecule can be another carbohydrate, forming disaccharides or polysaccharides, or a non-carbohydrate moiety, which is referred to as an aglycone in various biological compounds.

16. (C) Salivary alpha-amylase
Carbohydrate digestion begins immediately in the oral cavity through the action of salivary alpha-amylase. This enzyme is secreted by the salivary glands and catalyzes the hydrolysis of internal alpha-1,4-glycosidic bonds in starch, breaking down complex polysaccharides into smaller dextrins and maltose before the food bolus is swallowed and enters the highly acidic gastric environment.

17. (D) P-II, Q-III, R-I, S-IV
Salivary amylase is secreted in the mouth to initiate starch hydrolysis. Pancreatic amylase is active within the small intestine lumen to continue polysaccharide breakdown. Sucrase is a brush border enzyme localized on the small intestine microvilli that cleaves sucrose. Pepsin is a gastric protease involved in protein degradation and does not participate in carbohydrate digestion.

18. (C) Glucose enters the enterocyte against its gradient via the SGLT1 transporter and sodium ions.
Glucose absorption across the brush border membrane of enterocytes occurs via active transport mediated by the sodium-glucose cotransporter 1. This mechanism couples the entry of glucose against its concentration gradient with the downhill movement of sodium ions, which is maintained by the basolateral sodium-potassium ATPase pump, ensuring highly efficient absorption of dietary glucose.

19. (D) 1, 2, 3 and 4
Fructose is absorbed via facilitated diffusion using GLUT5, while galactose shares the

Click Here to Buy book on Amazon

SGLT1 transporter with glucose. Absorbed monosaccharides enter the portal circulation to the liver. Hepatic fructose metabolism bypasses phosphofructokinase, the main rate-limiting step of glycolysis, leading to rapid conversion into lipid precursors and highlighting the distinct metabolic pathway of this specific monosaccharide.

20. (D) Incorporating beta-glucan and replacing sucrose with isomaltulose
Incorporating beta-glucan increases viscosity in the digestive tract, which slows down gastric emptying and subsequent glucose absorption. Substituting sucrose with isomaltulose, a slowly digestible disaccharide characterized by a low glycaemic response, further ensures a steady and sustained release of glucose, effectively minimizing postprandial blood sugar spikes in individuals managing diabetes.

21. (C) A is true but R is false.
Foods with a high Glycaemic Index cause a rapid rise in blood glucose because they contain simple or highly gelatinized carbohydrates that are easily and rapidly hydrolyzed by digestive amylases. High GI foods lack structural barriers and resistant starches, making them highly susceptible to enzymatic breakdown and rapid absorption into the circulatory system.

22. (C) Cooking and subsequently cooling rice to promote retrogradation before consumption.
Type 3 resistant starch is formed through retrogradation, a process where gelatinized starch recrystallizes upon cooling. During this structural rearrangement, amylose chains realign into tight, double-helical structures stabilized by hydrogen bonds, which physically restricts access by digestive amylases, thereby rendering a portion of the starch indigestible in the human upper gastrointestinal tract.

23. (C) Statement I is correct and Statement II is incorrect.
Glycaemic Load integrates both the quality of the carbohydrate, represented by its Glycaemic Index, and the actual quantity consumed in a typical serving. Consequently, a food with a high Glycaemic Index will not automatically have a high Glycaemic Load if the serving size contains only a very small absolute amount of digestible carbohydrates.

24. (D) Extensive milling and particle size reduction of grains
Extensive milling and particle size reduction break down the protective botanical structures of grains and increase the surface area available for enzymatic attack. This physical disruption allows digestive amylases to rapidly hydrolyze the starch, leading to accelerated glucose absorption and a significantly higher Glycaemic Index compared to intact, minimally processed grain structures.

25. (B) Whole intact barley and lentils
Whole intact barley and lentils contain complex carbohydrates enclosed within rigid botanical cell walls, alongside high levels of soluble fibre and protein. This complex food matrix slows down enzymatic access and gastric emptying, resulting in a low glycaemic response that provides a slow, steady, and sustained release of glucose into the bloodstream over several hours.

NODIA

26. (C) Gluconeogenesis – Breakdown of glycogen to release free glucose
Gluconeogenesis is the metabolic pathway that synthesizes glucose from non-carbohydrate precursors, such as lactate, glycerol, and glucogenic amino acids, during fasting. The breakdown of glycogen to release free glucose is called glycogenolysis. Glycolysis and glycogenesis correctly represent glucose oxidation and glycogen synthesis, respectively, while the pentose phosphate pathway generates NADPH and ribose sugars.

27. (D) Chronic hyperinsulinemia leading to insulin resistance and Type 2 diabetes
Chronic consumption of diets with a high Glycaemic Load leads to persistent, elevated postprandial blood glucose spikes, forcing the pancreas to secrete high levels of insulin. Over time, this constant hyperinsulinemia downregulates insulin receptors and impairs intracellular signaling cascades, causing insulin resistance, metabolic syndrome, and eventually leading to the development of Type 2 diabetes.

28. (A) It predicts postprandial blood glucose responses to assist in glycaemic control.
The Glycaemic Index is a physiological ranking system that classifies carbohydrate-containing foods based on their immediate postprandial blood glucose response compared to a reference food. This concept is highly useful in clinical nutrition and diet planning to select foods that

promote stable blood sugar levels, assisting in the management of diabetes and metabolic health.

29. (B) It directly yields a net production of 36 ATP molecules per glucose molecule.
Glycolysis is an anaerobic pathway occurring in the cytosol that yields a net production of only two ATP molecules and two NADH molecules per molecule of glucose oxidized to pyruvate. The larger yield of thirty-six or thirty-eight ATP molecules requires downstream mitochondrial pathways, including the citric acid cycle and oxidative phosphorylation, under aerobic conditions.

30. (B) The generation of glucose from non-carbohydrate substrates like amino acids.
Gluconeogenesis is the metabolic synthesis of glucose from non-carbohydrate substrates, primarily occurring in the liver and kidneys. This pathway utilizes precursors such as glucogenic amino acids, lactate, pyruvate, and glycerol to maintain adequate blood glucose levels during prolonged periods of fasting, starvation, or intense physical exertion when glycogen stores are depleted.

31. (A) Serum albumin
Serum albumin is classified as a simple protein because it consists entirely of amino acid residues and yields only amino acids upon complete chemical or enzymatic hydrolysis. In contrast, hemoglobin, lipoproteins, and nucleoproteins are conjugated proteins, which contain non-protein prosthetic groups such as heme, lipids, or nucleic acids attached to the polypeptide backbone.

32. (C) P-III, Q-IV, R-I, S-II
Globulin is a simple protein soluble in dilute salt solutions. Casein is a conjugated phosphoprotein containing phosphate groups bound to the amino acid chain. Peptones are derived proteins produced during the partial hydrolysis of larger proteins. Zein, the storage protein of maize, lacks certain essential amino acids like lysine and tryptophan, classifying it as an incomplete protein.

33. (D) At physiological pH, they exist as zwitterions with both positive and negative charges.
Amino acids contain both an acidic carboxyl group and a basic amino group. At physiological pH, the carboxyl group loses a proton to become negatively charged, while the amino group gains a proton to become positively charged. This dual ionic state is known as a zwitterion, giving amino acids their characteristic amphoteric properties in biological systems.

34. (B) 1, 3 and 4 only
Leucine, isoleucine, and valine are essential branched-chain amino acids, while alanine and aspartic acid are non-essential. Histidine is essential for infants but required in smaller quantities by healthy adults. Tyrosine is a non-essential amino acid because the body can synthesize it directly from the essential amino acid phenylalanine, making the tyrosine statement incorrect.

35. (B) PDCAAS
The Protein Digestibility-Corrected Amino Acid Score is the current standard recommended by international authorities to evaluate protein quality. This method compares the amino acid profile of a test protein against a reference pattern, adjusted for its true fecal digestibility, providing a more accurate assessment of how effectively a protein source meets human nitrogen and amino acid requirements.

36. (A) Both A and R are true and R is the correct explanation of A.
Traditional diets frequently combine cereals and legumes to achieve protein complementation. Cereals contain adequate methionine but are deficient in lysine, whereas legumes are rich in lysine but lack sufficient methionine. Consuming these plant foods together ensures that the limiting amino acids of each are balanced, resulting in a complete and high-quality essential amino acid profile.

37. (A) Soy protein isolate
Soy protein isolate is one of the few single-source plant proteins that contains all essential amino acids in proportions that closely match human requirements. Consequently, it possesses a high biological digestibility and a Protein Digestibility-Corrected Amino Acid Score near the maximum value of 1.0, making it highly effective for formulating complete plant-based nutritional products.

38. (A) Both Statement I and Statement II are correct.
The Protein Efficiency Ratio evaluates protein quality based on the weight gain of a growing animal relative to its protein intake. Biological Value measures nitrogen retention compared to

NODIA

nitrogen absorption, indicating the efficiency with which the body utilizes absorbed amino acids for protein synthesis, rendering both descriptions of these protein evaluation metrics correct.

39. (A) Glutamine
Glutamine is classified as a non-essential or conditionally essential amino acid because the human body can synthesize it from other amino acids under normal physiological conditions. Phenylalanine, methionine, and tryptophan are essential amino acids that cannot be synthesized endogenously and must be obtained from dietary sources to support protein synthesis and maintain nitrogen balance.

40. (D) Kwashiorkor
Kwashiorkor is a severe form of protein-energy malnutrition characterized by a severe deficiency in dietary protein despite a relatively sufficient intake of total calories. This imbalance leads to clinical signs such as hypoalbuminemia, which causes fluid retention and bilateral edema, alongside hepatomegaly due to impaired lipoprotein synthesis, hair depigmentation, and extreme lethargy.

41. (B) PDCAAS – Measures weight gain of rats relative to standard casein diet
The Protein Efficiency Ratio, rather than the Protein Digestibility-Corrected Amino Acid Score, is determined by measuring the weight gain of growing rats fed a test protein relative to a reference casein diet. The PDCAAS is a chemical and physiological calculation based on the amino acid profile of the food adjusted for true fecal digestibility.

42. (C) Protein synthesis halts, and the remaining amino acids are deaminated for energy.
Protein synthesis is an all-or-nothing process that requires all twenty amino acids to be present simultaneously. If a single essential amino acid is missing or limiting, translation of the polypeptide chain halts. The unused amino acids cannot be stored in the body and are subsequently deaminated in the liver, where their carbon skeletons are oxidized for energy.

43. (A) 4, 1, 2, 3
Protein digestion begins as gastric hydrochloric acid denatures the folded tertiary structures of dietary proteins. This acidic environment activates pepsinogen to pepsin, which initiates peptide bond cleavage. The resulting polypeptides are further hydrolyzed in the small intestine by pancreatic proteases, and final cleavage into free amino acids is completed by brush border peptidases.

44. (A) Net Protein Utilization (NPU) is always equal to or greater than the Biological Value (BV).
Net Protein Utilization is mathematically defined as the Biological Value multiplied by the digestibility coefficient of the protein. Because protein digestibility is always equal to or less than one hundred percent, NPU is practically always lower than or equal to the Biological Value, making the assertion that NPU can be greater than BV incorrect.

45. (B) The alteration of higher-order protein structures without breaking peptide bonds.
Denaturation is a physical process in which proteins lose their native secondary, tertiary, or quaternary structures due to external stress or chemical agents. This structural disruption occurs without cleaving the covalent peptide bonds of the primary amino acid sequence, unfolding the polypeptide chain and typically rendering the protein biologically inactive or altering its functional properties.

46. (B) Reducing agents (e.g., mercaptoethanol)
Disulfide bonds are covalent linkages formed between the sulfhydryl groups of cysteine residues, stabilizing the tertiary structure of many proteins. Reducing agents, such as beta-mercaptoethanol or dithiothreitol, chemically reduce these disulfide linkages back to free sulfhydryl groups, disrupting the folded conformation and leading to the denaturation of the protein.

47. (A) P-III, Q-II, R-IV, S-I
Casein acts as an emulsifier to stabilize fat in processed meats. Egg white proteins provide foaming capacity essential for the structure of cakes. Myosin and actin in surimi undergo thermal gelation to form structured seafood products. Wheat gluten provides the elasticity and cohesive strength required for gas retention during dough formation in bread making.

48. (C) Rapid growth during infancy and childhood.
A positive nitrogen balance occurs when nitrogen intake exceeds nitrogen excretion, indicating that the body is actively retaining nitrogen to synthesize new tissues. This physiological state is characteristic of periods of rapid growth, such

Downloaded from www.pdf.tube

as infancy, childhood, and pregnancy, as well as recovery from illness or muscle hypertrophy during athletic training.

49. (B) 1, 2 and 4 only
Pepsin operates optimally in acidic gastric conditions, while trypsin and chymotrypsin are pancreatic endopeptidases that cleave specific peptide bonds in the small intestine. Aminopeptidase is an exopeptidase, rather than an endopeptidase, and is secreted by the intestinal mucosal cells rather than the pancreas, making the third statement in the list incorrect.

50. (C) Amphiphilic nature allowing orientation at the oil-water interface
Egg yolk proteins, such as lipovitellin and LDL, possess an amphiphilic molecular structure containing both hydrophilic and hydrophobic amino acid regions. This physical property allows these proteins to align at the boundary between polar water and non-polar oil phases, reducing interfacial tension and forming a stable protective film that prevents oil droplets from coalescing.

51. (C) A is true but R is false.
Thermal denaturation unfolds the complex three-dimensional structure of proteins, exposing the peptide backbone to digestive proteases and increasing digestibility. However, denaturation does not hydrolyze the primary amino acid sequence; instead, actual cleavage of peptide bonds is carried out enzymatically by gastric and pancreatic proteases in the digestive tract, making the reason false.

52. (D) Over-denaturation causes excessive coagulation and film rigidity, leading to water syneresis.
Excessive mechanical beating introduces high shear forces that over-denature egg white proteins, causing them to coagulate into a highly rigid and tight network. This excessive aggregation squeezes out the water molecules trapped within the protein film, leading to the collapse of the foam structure and the separation of liquid, a process known as syneresis.

53. (A) Both Statement I and Statement II are correct.
Nitrogen balance is calculated by subtracting total nitrogen excretion from dietary nitrogen intake. In healthy, weight-stable adults who consume a nutritionally adequate diet, the amount of nitrogen consumed matches the amount lost in bodily waste and sweat, maintaining a state of nitrogen equilibrium where net protein synthesis balances degradation.

54. (C) Serving as the primary storage form of metabolic energy
Proteins serve crucial structural, catalytic, and regulatory roles in the human body, but they do not function as the primary storage form of metabolic energy. Carbohydrates, stored as glycogen, and lipids, stored as triglycerides in adipose tissue, are the primary macronutrients utilized by the body for energy storage and mobilization.

55. (A) Inadequate non-protein calories force the body to deaminate proteins for energy.
When non-protein caloric intake from carbohydrates and fats is insufficient to meet energy demands, the body is forced to mobilize amino acids for gluconeogenesis and energy production. This metabolic shift requires the deamination of dietary and structural proteins, resulting in elevated nitrogen excretion in the urine and a negative nitrogen balance despite high protein intake.

56. (D) Sphingolipids – Polysaccharides bound to lipids
Sphingolipids are complex lipids characterized by a sphingosine backbone linked to a fatty acid and a polar head group, rather than being composed of polysaccharides bound to lipids. Simple lipids comprise triglycerides and waxes, while compound lipids include phospholipids and glycolipids. Derived lipids encompass free fatty acids, sterols, and fat-soluble vitamins.

57. (B) HCl lowers pH, activates pepsinogen to pepsin, and denatures dietary proteins.
The secretion of hydrochloric acid by parietal cells lowers gastric pH to a highly acidic range. This low pH denatures folded dietary proteins, making their peptide bonds accessible to enzymatic attack. Additionally, the acidic environment is essential for cleaving the inactive zymogen pepsinogen into active pepsin, initiating the digestion of proteins.

NODIA

58. (C) They act as emulsifiers due to their hydrophilic heads and hydrophobic tails.
Phospholipids are amphiphilic molecules containing a hydrophilic phosphate head and two hydrophobic fatty acid tails. This unique physical structure allows them to orient themselves at

oil-water interfaces, stabilizing emulsions in food products like mayonnaise and margarine by preventing the separation of immiscible liquid phases, with lecithin being a prominent example.

59. (D) Cholesterol yields 9 kcal/g of energy when oxidized in human cells.
Cholesterol is a critical structural component of cell membranes and acts as a biochemical precursor for bile acids and steroid hormones. Plant sterols can competitively inhibit its absorption. However, cholesterol is not utilized as a metabolic fuel source and does not yield nine kilocalories per gram of energy, making that statement incorrect.

60. (A) Esters of fatty acids with long-chain monohydric alcohols.
Waxes are classified as simple lipids and are chemically defined as esters formed from the union of long-chain fatty acids with high molecular weight monohydric alcohols. This hydrophobic composition provides protective, water-resistant coatings on the surfaces of plants, fruits, and insects, distinguishing them from triglycerides which utilize a glycerol backbone.

61. (B) Linoleic acid
Linoleic acid is an essential polyunsaturated fatty acid containing eighteen carbon atoms and two double bonds in its hydrocarbon chain. In contrast, stearic acid and palmitic acid are fully saturated fatty acids containing no double bonds, while oleic acid is a monounsaturated fatty acid containing a single double bond.

62. (B) P-III, Q-IV, R-I, S-II
Palmitic acid is a saturated fatty acid represented by C16:0. Oleic acid is an eighteen-carbon monounsaturated fatty acid represented by C18:1 n-9. Linoleic acid is a polyunsaturated omega-6 fatty acid designated as C18:2 n-6. Arachidonic acid is a twenty-carbon polyunsaturated fatty acid with four double bonds designated as C20:4 n-6.

63. (A) Trans fats are formed during partial hydrogenation of vegetable oils, isomerizing cis double bonds to trans configuration.
Partial hydrogenation is an industrial process that adds hydrogen to unsaturated vegetable oils to increase stability and melting point. During this high-temperature catalytic reaction, some of the remaining cis double bonds undergo geometric isomerization, converting into a more linear trans configuration, which results in the formation of trans fatty acids.

64. (B) 1, 3 and 4 only
Saturated fats contain no double bonds, while polyunsaturated fats are liquid at room temperature due to molecular bending at their cis double bonds. High intake of trans fats is linked to elevated LDL and reduced HDL cholesterol. Natural monounsaturated fatty acids typically possess cis double bonds, not trans, making the second statement incorrect.

65. (D) Infrared spectroscopy detecting a strong absorption peak at 966 cm^{-1}.
Infrared spectroscopy is a highly reliable analytical technique used to detect trans fatty acids in food samples. The trans configuration of double bonds exhibits a characteristic and distinct C-H out-of-plane deformation absorption band around 966 reciprocal centimeters, which confirms the presence of trans fats and would invalidate a "Zero Trans Fat" labeling claim.

66. (A) Both A and R are true and R is the correct explanation of A.
Omega-3 fatty acids like eicosapentaenoic acid and docosahexaenoic acid possess anti-inflammatory properties because they compete with arachidonic acid, an omega-6 fatty acid, for the active sites of cyclooxygenase enzymes. This competitive inhibition reduces the synthesis of highly pro-inflammatory eicosanoids, instead generating less inflammatory mediators that help modulate the systemic immune response.

67. (B) Blending high-oleic oil with some saturated fat to resist oxidation without adding trans fats.
High-oleic oils are rich in monounsaturated fatty acids, which are significantly more resistant to thermal oxidation during deep frying than polyunsaturated fats like alpha-linolenic acid. Blending high-oleic oil with stable saturated fats creates a frying medium that resists rancidity and polymerization under high heat without generating harmful trans configuration fatty acids.

68. (A) Both Statement I and Statement II are correct.
Linoleic acid is an eighteen-carbon polyunsaturated fatty acid containing two double bonds, serving as the essential parent precursor for the synthesis of omega-6 fatty acids. Alpha-linolenic acid is an

Click Here to Buy book on Amazon

eighteen-carbon polyunsaturated fatty acid with three double bonds, acting as the primary parent precursor for the omega-3 fatty acid family.

69. (A) Coconut oil
Coconut oil is composed predominantly of medium-chain saturated fatty acids, such as lauric acid, and contains virtually no omega-3 polyunsaturated fatty acids. In contrast, flaxseeds, walnuts, and cold-water fish like salmon are recognized as rich dietary sources of omega-3 fatty acids, providing alpha-linolenic acid, eicosapentaenoic acid, and docosahexaenoic acid, respectively.

70. (C) The oil has undergone partial hydrogenation, which contradicts their claim.
Elaidic acid is the principal trans isomer of oleic acid and is not found in high concentrations in natural, unhydrogenated vegetable oils. Its presence in frying oil is a definitive chemical indicator that the oil has undergone industrial partial hydrogenation, directly contradicting the establishment's claim of using only natural, unhydrogenated oils.

71. (A) Linoleic acid – Omega-3 PUFA
Linoleic acid is an essential polyunsaturated fatty acid that belongs to the omega-6 family, not the omega-3 family, as its first double bond is located at the sixth carbon from the methyl end. Arachidonic acid is an omega-6 PUFA, while eicosapentaenoic acid is an omega-3 PUFA, and oleic acid is an omega-9 MUFA.

72. (D) To increase oxidative stability and produce semi-solid fats like margarine.
Partial hydrogenation decreases the number of double bonds in liquid vegetable oils, which significantly reduces their susceptibility to oxidative rancidity and thermal degradation. Additionally, this reaction alters the physical properties of the oil, raising its melting point to produce functional, semi-solid fats such as margarine and shortening suitable for commercial baking and food manufacturing.

73. (A) 1, 3, 2, 4
Lipid digestion begins as bile salts emulsify large fat droplets into smaller particles in the duodenum. Pancreatic lipase then hydrolyzes these triglycerides into free fatty acids and monoglycerides. These products are incorporated into mixed micelles for transport across the brush border, where they are re-esterified and packaged into chylomicrons inside the enterocytes.

74. (C) Trans fatty acids have lower melting points than corresponding cis isomers.
Saturated fatty acids and those with longer chain lengths exhibit higher melting points. Introducing cis double bonds creates a kink in the carbon chain, preventing tight molecular packing and lowering the melting point. Trans double bonds maintain a linear shape, allowing tighter packing, which gives trans fatty acids higher melting points than their cis counterparts.

NODIA

75. (D) Polyunsaturated fatty acids that the body cannot synthesize and must obtain from diet.
Essential fatty acids are specific polyunsaturated fatty acids, such as linoleic acid and alpha-linolenic acid, which are vital for human physiological health. Because the human body lacks the desaturase enzymes required to introduce double bonds beyond the carbon-9 position, it cannot synthesize these molecules endogenously, requiring their direct intake from dietary sources.

76. (A) Pancreatic lipase
Pancreatic lipase is the primary digestive enzyme responsible for hydrolyzing the majority of dietary triglycerides in the small intestine. Secreted by the pancreas into the duodenum, it acts at the oil-water interface of emulsified lipid droplets, cleaving fatty acids from the 1 and 3 positions of triglycerides to yield free fatty acids and 2-monoglycerides.

77. (B) P-III, Q-I, R-IV, S-II
Chylomicrons transport exogenous dietary lipids from the intestine to tissues. Very-low-density lipoproteins transport endogenous triglycerides synthesized in the liver. Low-density lipoproteins deliver cholesterol to peripheral tissues, while high-density lipoproteins perform reverse cholesterol transport, picking up excess cholesterol from the tissues and returning it back to the liver for excretion.

78. (B) Micelles solubilize digestion products to transport them to the enterocytes.
Mixed micelles are tiny spherical aggregates formed by bile salts, monoglycerides, free fatty acids, and fat-soluble vitamins. Their hydrophobic cores encapsulate insoluble lipid digestion products, while their hydrophilic shells allow them to remain dissolved in the aqueous chyme of the

intestinal lumen, successfully transporting lipids to the brush border of enterocytes for absorption.

79. (B) 1, 3 and 4 only
Lipolysis releases fatty acids from triglycerides, which are then oxidized via beta-oxidation to yield acetyl-CoA, particularly when carbohydrate levels are low. Ketogenesis is stimulated during low carbohydrate availability to supply alternative fuels. Because beta-oxidation occurs inside the mitochondria rather than the cytoplasm, the second statement regarding its cellular location is incorrect.

80. (C) Peroxide Value
The Peroxide Value is a widely accepted chemical assay used to measure the concentration of hydroperoxides, which are the primary oxidation products formed during the initial stages of lipid degradation. This test provides a quantitative assessment of early-stage rancidity and oxidative damage before these unstable peroxides break down into secondary volatile compounds.

81. (A) Both A and R are true and R is the correct explanation of A.
Butylated Hydroxytoluene is a highly effective synthetic antioxidant added to fat-containing foods to inhibit lipid autoxidation. It acts as a primary antioxidant by donating hydrogen atoms from its hydroxyl group to lipid free radicals, converting them into stable non-radical species and terminating the self-propagating free radical chain reaction that leads to rancidity.

82. (C) Heat inactivates endogenous milk lipases, preventing hydrolytic rancidity.
Raw milk contains endogenous lipolytic enzymes, particularly lipoprotein lipase, which can hydrolyze milk fats into free fatty acids, causing off-flavours. Prompt pasteurization utilizes controlled heat treatment to denature and inactivate these enzymes. This thermal inactivation halts the enzymatic hydrolysis of triglycerides, successfully preventing the development of soapy and bitter hydrolytic rancidity.

83. (A) Both Statement I and Statement II are correct.
Dietary fats have a high physiological fuel value of approximately nine kilocalories per gram, which is more than double that of carbohydrates or proteins. This high energy density is due to their highly reduced chemical structure, featuring a high ratio of carbon and hydrogen atoms relative to oxygen, releasing more energy upon oxidation.

84. (D) Storage under a strict nitrogen atmosphere
Lipid oxidation requires molecular oxygen to initiate and propagate the free radical chain reaction. Storing fats under a strict nitrogen atmosphere displaces oxygen, effectively preventing the initiation of auto-oxidation. In contrast, exposure to ultraviolet light, trace transition metal catalysts, and a high degree of fatty acid unsaturation all accelerate the rate of oxidative rancidity.

85. (A) High moisture catalyzed hydrolytic rancidity, releasing fatty acids.
High residual moisture in potato chips fried in palm oil provides the water necessary to catalyze the non-enzymatic hydrolysis of triglycerides under high heat. This hydrolytic reaction cleaves fatty acids from the glycerol backbone, releasing free fatty acids that impart a distinct soapy off-flavour and lower the smoke point of the frying medium.

86. (C) Dietary Fibre – 7 kcal/g
Under the Atwater system, carbohydrates and proteins provide approximately four kilocalories per gram, while dietary fats yield nine kilocalories per gram. Dietary fibre is resistant to human digestion and is fermented in the colon to yield short-chain fatty acids, contributing an estimated energy value of zero to two kilocalories per gram, not seven.

87. (A) It hydrolyzes triglycerides into fatty acids, accelerating rancidity and lowering the smoke point.
Water introduced into hot frying oil during cooking undergoes a rapid thermal reaction that hydrolyzes the ester bonds of triglycerides. This hydrolytic degradation releases free diglycerides, monoglycerides, and free fatty acids. The accumulation of these free fatty acids accelerates overall lipid degradation, promotes hydrolytic rancidity, and significantly reduces the smoke point of the oil.

88. (D) They satisfy energy demands, allowing proteins to be used for tissue repair and synthesis.
The protein-sparing action of carbohydrates and fats is a key nutritional principle where these non-protein macronutrients are metabolized first to meet the body's daily energy requirements. This

Downloaded from www.pdf.tube

metabolic prioritization prevents the catabolism of dietary and structural proteins, allowing amino acids to be preserved for vital functions such as tissue growth, repair, and enzyme synthesis.

89. (B) VLDL primarily transports dietary cholesterol absorbed directly from the stomach.
Very-low-density lipoproteins are synthesized and secreted by the liver to transport endogenous triglycerides and cholesterol to peripheral tissues, rather than transporting absorbed dietary cholesterol from the stomach. Dietary lipids are absorbed in the small intestine and packaged into chylomicrons, which enter the lymphatic system to transport these exogenous lipids.

90. (C) An indicator of primary oxidation, measuring the concentration of hydroperoxides.
The Peroxide Value is a chemical index that quantifies the milliequivalents of active oxygen per kilogram of fat or oil. It directly measures the concentration of hydroperoxides, which are the primary products formed during the initial stage of lipid auto-oxidation, serving as a reliable indicator of early-stage rancidity and oxidative degradation.

91. (D) Acetyl-CoA
Acetyl-CoA is the central metabolic intermediate that connects the pathways of carbohydrate, lipid, and protein metabolism. It is produced by the decarboxylation of pyruvate, the beta-oxidation of fatty acids, and the catabolism of ketogenic amino acids. It then enters the citric acid cycle for energy generation or serves as a precursor for lipogenesis.

92. (A) P-III, Q-II, R-I, S-IV
Proteins exhibit the highest Thermic Effect of Food, requiring twenty to thirty percent of their energy value for digestion and processing. Carbohydrates have a moderate effect of five to ten percent, while fats have a very low effect of zero to three percent. A standard mixed diet typically averages around ten percent total energy expenditure.

93. (B) Carbohydrates can be converted to fatty acids via lipogenesis using Acetyl-CoA.
During periods of excess caloric intake, carbohydrates undergo glycolysis to produce pyruvate, which is converted into acetyl-CoA. This excess acetyl-CoA is then utilized as the building block for the synthesis of fatty acids via the lipogenesis pathway in the liver. Humans cannot convert fatty acids back into glucose as the pyruvate dehydrogenase reaction is irreversible.

94. (A) 1, 2 and 4 only
Gluconeogenesis uses non-carbohydrate precursors like glucogenic amino acids and glycerol from fats to synthesize glucose, a pathway that is highly active during carbohydrate restriction. However, even-chain fatty acids are metabolized to acetyl-CoA, which cannot be converted to pyruvate in humans, meaning even-chain fatty acids cannot serve as substrates for net glucose synthesis.

95. (A) Dietary fats
Dietary fats are highly concentrated sources of energy, providing nine kilocalories per gram, which is more than double the energy density of carbohydrates or proteins. This high energy density allows therapeutic foods to deliver sufficient calories in a small volume, while keeping osmotic pressure low and minimizing the renal solute load in malnourished children.

96. (A) Both A and R are true and R is the correct explanation of A.
During severe starvation or diabetes, the lack of intracellular glucose forces the body to rely on gluconeogenesis, which depletes oxaloacetate. Consequently, acetyl-CoA produced from rapid beta-oxidation of fatty acids cannot enter the citric acid cycle and is diverted to the hepatic ketogenesis pathway, leading to the accumulation of ketone bodies in the blood.

97. (D) The brain adapts to use ketone bodies as its primary fuel source, sparing muscle protein.
During prolonged fasting, the brain undergoes a critical metabolic adaptation to utilize circulating ketone bodies, such as acetoacetate and beta-hydroxybutyrate, as its primary fuel. This shift reduces the body's reliance on gluconeogenesis, which significantly decreases the rate of skeletal muscle protein breakdown that would otherwise be required to supply glucogenic amino acids for glucose synthesis.

98. (A) Both Statement I and Statement II are correct.
Plant-based dietary sources naturally contain unsaturated fats and are entirely free of cholesterol, as cholesterol is synthesized exclusively by animal cells. Conversely, animal-based foods are the primary sources of both dietary cholesterol and

NODIA

saturated fatty acids, demonstrating that the nutritional lipid composition is highly distinct between plant and animal food matrices.

99. (B) Serving as the primary substrate for oxidative ATP generation in cardiac muscle.
Cholesterol is a vital lipid that regulates cell membrane fluidity and serves as the essential biological precursor for synthesizing bile acids, vitamin D, and steroid hormones like estrogen and testosterone. However, cholesterol is not metabolized as an energy substrate and is not oxidized to generate ATP in cardiac or skeletal tissues.

100. (D) Vitamin B12, complete protein, and long-chain Omega-3s
Strict vegan diets exclude all animal products, which puts individuals at risk of deficiencies in nutrients predominantly found in animal foods. Vitamin B12 is synthesized exclusively by microorganisms and is absent in plant foods. Vegans may also lack complete proteins with optimal amino acid scores and long-chain omega-3 fatty acids like EPA and DHA.

101. (A) Egg – Valine
Egg protein contains a highly balanced profile of all essential amino acids and has no limiting amino acid, serving as a standard reference protein with a high biological value. In contrast, wheat is limited by lysine, legumes are limited by methionine, and maize is deficient in both lysine and tryptophan, making the egg pairing incorrect.

102. (C) Amino acids are deaminated, increasing kidney urea burden, with carbon skeletons stored as fat.
Consuming protein in excess of immediate metabolic requirements leads to the deamination of surplus amino acids in the liver. This process produces toxic ammonia, which is converted into urea for excretion, increasing the renal solute load. The remaining carbon skeletons are converted into acetyl-CoA or glucose, which are subsequently stored as fat or oxidized.

103. (A) 2, 4, 1, 3
During starvation, the body first utilizes circulating exogenous glucose for energy. Once depleted, the liver breaks down its stored glycogen reserves. After glycogen is exhausted, the body mobilizes stored triglycerides from adipose tissue via lipolysis. Finally, during prolonged starvation, structural muscle proteins are catabolized to supply glucogenic amino acids for survival.

104. (D) It is strongly stimulated by the hormone glucagon during periods of fasting.
Lipogenesis is the metabolic pathway that synthesizes fatty acids from acetyl-CoA, primarily in the liver and adipose tissue. It utilizes NADPH as a reducing agent and is stimulated by high insulin levels after meals. Glucagon, which is secreted during fasting, inhibits lipogenesis by downregulating acetyl-CoA carboxylase, making the statement regarding its stimulation incorrect.

105. (B) The ratio of essential nutrients provided by a food relative to its calories.
Nutrient density is an essential nutritional metric that evaluates the concentration of beneficial nutrients, such as vitamins, minerals, dietary fibre, and protein, relative to the total energy content of a food. Foods with high nutrient density provide a rich supply of micronutrients for a minimal number of calories, supporting overall metabolic health.

106. (C) Marasmus
Marasmus is a severe form of protein-energy malnutrition resulting from a chronic deficit in both total energy and dietary protein. This combined deficiency forces the body to catabolize its own tissues for survival, leading to clinical features such as severe muscle wasting, the absence of subcutaneous fat, a characteristic wizened appearance, and growth retardation.

107. (D) P-II, Q-I, R-IV, S-III
Saturated and trans fats contribute to cardiovascular disease through arterial lipid deposition. Severe protein deficiency with adequate calories causes Kwashiorkor, characterized by edema. Excess refined carbohydrates lead to insulin resistance and metabolic syndrome. Deficiency of essential fatty acids impairs cell membrane integrity, leading to scaly dermatitis and poor wound healing.

108. (A) Dietary fats are necessary for absorbing and transporting fat-soluble vitamins.
Beyond their role as a concentrated source of energy, dietary lipids are essential for the physiological absorption of fat-soluble vitamins A, D, E, and K in the small intestine. Fats facilitate the formation of mixed micelles, which solubilize these vitamins and allow them to cross the brush

Click Here to Buy book on Amazon

border membrane of enterocytes into systemic circulation.

109. (B) 1, 2 and 4 only
The Maillard reaction is a non-enzymatic browning process requiring a reducing sugar and a free amino group, accelerated by high heat and low moisture. Because this pathway is purely chemical and does not involve enzymatic catalysis by polyphenol oxidase, which instead drives enzymatic browning, the third statement in the list is incorrect.

110. (B) Kjeldahl method
The Kjeldahl method is the international reference standard used to determine the total nitrogen content of food and beverage products. Once the total nitrogen is measured through acid digestion, distillation, and back titration, it is multiplied by a nitrogen-to-protein conversion factor to calculate the crude protein concentration, verifying regulatory compliance of nutritional claims.

111. (A) Both A and R are true and R is the correct explanation of A.
Heating starch in excess water drives gelatinization, causing a significant increase in viscosity. The thermal energy disrupts the intermolecular hydrogen bonds holding the starch granule together, which allows water molecules to penetrate and swell the granules. As swelling continues, amylose leaches out into the surrounding solution, forming a viscous paste.

112. (C) Retrogradation, where starch chains realign and recrystallize, expelling water.
Staling in baked bread is primarily driven by retrogradation, a process where gelatinized starch molecules realign and recrystallize during cooling and storage. Amylose and amylopectin chains reform hydrogen bonds, expelling water from the starch gel matrix in a process called syneresis. This structural realignment shifts water away, turning the bread crumb firm, dry, and crumbly.

113. (A) Both Statement I and Statement II are correct.
Non-enzymatic browning occurs via distinct chemical pathways. Caramelization is the direct thermal degradation of carbohydrates at high temperatures in the absence of nitrogenous compounds. The Maillard reaction is a complex chemical network initiated by the condensation of a reducing sugar with an amino acid or protein, leading to the formation of brown melanoidin pigments.

114. (C) Emulsification of oil and water phases
Carbohydrates provide sweetening, bind water to thicken and gel foods, and act as cryoprotectants to depress the freezing point in frozen desserts. However, they lack the amphiphilic properties required to act as primary emulsifiers to stabilize oil and water phases, a role typically performed by proteins and phospholipids, making emulsification incorrect.

115. (B) Incorporating hydrocolloids to provide a viscoelastic network.
In gluten-free baking, the absence of the gluten protein network prevents the dough from retaining fermentation gases and maintaining elasticity. To overcome this, food technologists incorporate hydrocolloids, such as xanthan gum or guar gum. These hydrocolloids bind water and form a viscoelastic gel network that mimics the structural and gas-holding properties of gluten.

116. (D) Dextrinization – Formation of stable oil-in-water emulsion
Dextrinization is the thermal breakdown of starch into smaller dextrins under dry heat, which alters flavor and solubility but does not assist in emulsification. Protein coagulation drives the firming of boiled eggs, starch gelatinization thickens hot gravies, and syneresis represents the weeping of water from set gels, making the dextrinization pairing incorrect.

117. (A) Amylose molecules re-associate tightly (retrogradation), squeezing out the trapped water matrix.
During storage, the gelatinized starch gel undergoes retrogradation as amylose molecules realign and reform hydrogen bonds to establish a highly ordered, crystalline structure. This progressive molecular tightening shrinks the starch network, reducing its water-binding capacity and squeezing out the trapped water from the gel matrix, which manifests as visible surface syneresis.

118. (C) They function as emulsifiers and complex with amylose to retard staling.
Mono- and diglycerides are amphiphilic molecules containing both hydrophobic fatty acid chains and hydrophilic hydroxyl groups. In baked goods, they act as emulsifiers to improve fat dispersion. Furthermore, they form helical complexes

Downloaded from www.pdf.tube

with amylose, which physically inhibits the recrystallization and retrogradation of starch, effectively delaying the onset of staling in bread products.

119. (A) Fatty liver (hepatomegaly) is a common clinical feature in Marasmus, but rarely seen in Kwashiorkor.
Hepatomegaly due to fatty liver is a classic clinical feature of Kwashiorkor, caused by a lack of apolipoproteins needed to export triglycerides from the liver. In contrast, Marasmus is a generalized starvation where fat stores are depleted, meaning fatty liver is rarely present, making the assertion that hepatomegaly is common in Marasmus incorrect.

120. (D) The breakdown of starch into smaller dextrins upon the application of dry heat.
Dextrinization is a non-enzymatic chemical process where starch is heated under dry conditions. This thermal energy cleaves the complex glucosidic chains of starch into shorter, highly soluble glucose polymers called dextrins. This transformation reduces the thickening power of the starch while producing sweet flavors and characteristic brown colors in baked crusts.

121. (B) 70-80% Fat, 10-20% Protein, 5-10% Carbohydrate
A classic ketogenic diet is formulated with a high proportion of dietary fat to induce metabolic ketosis. By providing seventy to eighty percent of total energy from fats, keeping protein intake moderate, and restricting carbohydrates to under ten percent, the body is forced to transition away from glucose oxidation toward hepatic beta-oxidation of fatty acids.

122. (C) P-II, Q-III, R-I, S-IV
The ketogenic diet restricts carbohydrates to induce ketosis. The Paleolithic diet emphasizes high protein while excluding grains and dairy. The Mediterranean diet focuses on monounsaturated fats from olive oil and unrefined carbohydrates. The DASH diet is a low-sodium regimen rich in fruits, vegetables, and low-fat dairy designed to manage blood pressure.

123. (D) It can cause increased renal solute load and dehydration from excreting excess urea.
Sustaining a very high-protein diet generates a large amount of nitrogenous waste, as excess amino acids are deaminated to produce urea. This high concentration of urea increases the solute load on the kidneys, requiring a larger volume of water for urinary excretion, which can lead to progressive dehydration if fluid intake is inadequate.

124. (A) 1, 2 and 3 only
Low-carbohydrate diets deplete glycogen stores, fat-modified diets recommend replacing saturated lipids with unsaturated options, and high-protein intake increases thermogenesis. However, the ketogenic diet is designed to transition the brain toward utilizing ketone bodies for energy rather than relying on glycolysis, making the fourth statement in the list completely incorrect.

NODIA

125. (B) Sugar alcohols providing fewer calories than sucrose with a lower glycaemic effect.
Maltitol and sorbitol are polyols, commonly referred to as sugar alcohols, which are hydrogenated carbohydrates. They are only partially absorbed in the small intestine, providing fewer calories per gram than sucrose. Because they do not cause rapid insulin secretion, they exert a lower glycaemic effect, making them suitable for diabetic and low-sugar formulations.

126. (A) Both A and R are true and R is the correct explanation of A.
Resistant starch acts as a prebiotic because it resists enzymatic hydrolysis in the human upper digestive tract. It passes intact into the colon, where it is fermented by beneficial gut microbiota. This fermentation process produces short-chain fatty acids, such as butyrate, which lower luminal pH and support the health of the colon lining.

127. (A) Its microparticulated spherical structure rolls on the tongue, mimicking fat mouthfeel.
Microparticulated whey protein is subjected to a physical process that shapes the protein into tiny, spherical particles. These microscopic spheres are so small that they easily roll over the sensory receptors of the tongue rather than being perceived as individual particles, physically mimicking the creamy texture, lubricity, and smooth mouthfeel of dietary fats.

128. (D) Statement I is incorrect and Statement II is correct.
Carbohydrate-based fat replacers like maltodextrins and gums still yield some energy, typically providing one to four kilocalories per gram through digestion or fermentation, rather than zero. Olestra is a sucrose polyester that

cannot be cleaved by digestive lipases, passing through the tract unabsorbed and delivering zero kilocalories of metabolizable energy to the body.

129. (D) Legumes and whole grains
A classic ketogenic diet requires restricting carbohydrate intake to induce and maintain metabolic ketosis. Legumes and whole grains are rich sources of complex carbohydrates and starches, which would provide glucose and suppress ketone production. Instead, the diet encourages healthy fats, oils, moderate protein, and low-carbohydrate leafy vegetables to sustain ketosis.

130. (C) Incompletely absorbed sugar alcohols exerted an osmotic effect in the colon, causing diarrhea.
Sugar alcohols, or polyols, are only partially digested and absorbed in the human small intestine. When consumed in large quantities, the unabsorbed polyols pass into the large intestine, where they exert an osmotic effect, drawing water into the intestinal lumen. This water accumulation, combined with bacterial fermentation, causes abdominal distress, bloating, and osmotic diarrhea.

131. (B) Xylitol – Provides 0 kcal/g and is completely inert in the human body.
Xylitol is a sugar alcohol that is not metabolically inert; it is absorbed and metabolized by the body, yielding approximately 2.4 kilocalories per gram, which is lower than sucrose but greater than zero. Aspartame provides minimal calories due to high potency, while sucralose and saccharin pass through the body without contributing metabolizable energy.

132. (D) The liver converts fatty acids into ketone bodies to supply energy to the central nervous system.
Severely restricting dietary carbohydrates depletes glycogen stores and lowers insulin levels. This metabolic state accelerates lipolysis, releasing fatty acids that undergo beta-oxidation in the liver to produce acetyl-CoA. Because oxaloacetate is diverted to gluconeogenesis, the excess acetyl-CoA is converted into ketone bodies, which cross the blood-brain barrier to fuel the central nervous system.

133. (A) 2, 1, 4, 3
The Maillard reaction begins with the condensation of a reducing sugar with a free amino group to form a Schiff base. This intermediate undergoes isomerization to form stable Amadori or Heyns rearrangement products, which subsequently dehydrate and degrade into reactive dicarbonyl compounds. Finally, these reactive intermediates polymerize to form brown, nitrogenous melanoidin pigments.

134. (C) It guarantees weight loss regardless of total caloric intake or food composition during the eating window.
Intermittent fasting facilitates weight loss by restricting the eating window, which helps reduce overall energy intake and lowers insulin levels to promote fat oxidation. However, it does not guarantee weight loss if an individual consumes an excess of calories or poor-quality food during the eating phase, as weight management still depends on overall energy balance.

135. (A) Carbohydrate- or protein-based fat substitutes that mimic fat properties with fewer calories.
Fat mimetics are specialized food-grade ingredients derived from carbohydrates or proteins designed to imitate the sensory and physical properties of natural fats. They bind water to recreate the creaminess, viscosity, and mouthfeel of lipids in food systems, but provide significantly less metabolizable energy than the nine kilocalories per gram typically supplied by dietary fats.

136. (D) 0.83 to 1.0 g per kg of body weight per day
Standard nutritional guidelines recommend a safe daily protein intake of approximately 0.83 to 1.0 gram per kilogram of body weight for a healthy, sedentary adult. This level of intake is calculated to meet the metabolic requirements for nitrogen balance and support tissue maintenance and repair across nearly all healthy individuals in a population.

137. (B) P-IV, Q-III, R-II, S-I
Thiamine acts as a cofactor for oxidative decarboxylation, such as converting pyruvate to acetyl-CoA. Pyridoxal phosphate is essential for the transamination of amino acids. Biotin is required for carboxylation reactions, including those in fatty acid synthesis. Pantothenic acid is a structural component of Coenzyme A, which plays a central role in macronutrient energy metabolism.

Click Here to Buy book on Amazon

138. (C) Total Nitrogen × 6.25
Most food proteins contain approximately sixteen percent nitrogen by weight. Consequently, a standard conversion factor of 6.25, which is the mathematical reciprocal of 0.16, is widely applied to convert the total nitrogen content measured in a mixed food sample into an accurate estimate of the crude protein concentration of the product.

139. (A) 1 and 2 only
Soluble dietary fibres like pectin dissolve in water to form highly viscous gels that slow digestion, whereas insoluble fibres like cellulose provide mechanical bulk to promote intestinal motility. Pectin is a soluble fibre, and cellulose is highly resistant to bacterial fermentation in the human colon, making the third and fourth statements incorrect.

140. (A) 78 kcal
Using the standard Atwater physiological fuel factors, the metabolizable energy is calculated by multiplying the mass of each macronutrient by its energy density. Ten grams of carbohydrates yield forty kilocalories, five grams of protein yield twenty kilocalories, and two grams of fat yield eighteen kilocalories, resulting in a total energy content of seventy-eight kilocalories.

141. (A) Both A and R are true and R is the correct explanation of A.
The Biological Value of a whole egg is considered to be one hundred because its protein profile contains all essential amino acids in amounts that align with human physiological requirements. This optimal balance ensures that nearly all of the absorbed nitrogen is retained by the body and utilized for protein synthesis and tissue maintenance.

142. (B) Incorporating rosemary extract containing natural phenolic antioxidants.
Rosemary extract contains active phenolic compounds, such as carnosic acid and rosmarinic acid, which act as primary antioxidants. These natural compounds donate hydrogen atoms to free radicals formed during lipid oxidation, terminating the radical chain reaction. This intervention effectively delays the development of oxidative rancidity in frozen meat products without requiring synthetic chemical preservatives.

143. (A) Both Statement I and Statement II are correct.
Polyunsaturated fatty acids are highly susceptible to oxidative rancidity because they contain multiple double bonds separated by methylene groups. The presence of these methylene-interrupted structures significantly lowers the carbon-hydrogen bond dissociation energy of the adjacent allylic carbon, making it extremely easy for oxygen to abstract a hydrogen atom and initiate lipid autoxidation.

144. (C) Serving as the primary precursor for the synthesis of essential amino acids.
Dietary carbohydrates provide metabolic energy, spare proteins from catabolism, prevent ketosis, and supply ribose backbones for nucleic acids. However, they do not serve as precursors for essential amino acids. Essential amino acids cannot be synthesized endogenously by the human body from any carbohydrate carbon skeletons and must be obtained directly from dietary protein.

145. (D) The formula is slightly low in methionine, requiring supplementation to reach 1.0.
Soy protein isolate is a high-quality plant protein, but it is slightly deficient in the sulfur-containing essential amino acid methionine. To ensure that an infant formula based on soy meets the complete nutritional requirements for rapid growth, manufacturers must supplement the product with L-methionine to raise its amino acid score and achieve a PDCAAS of 1.0.

NODIA

146. (C) Pancreatic lipase – Highly acidic pH (~2.0)
Pancreatic lipase is secreted into the duodenum, where the acidic stomach chyme is neutralized by bicarbonate secretions. This enzyme operates optimally in a slightly alkaline environment of approximately pH 7.0 to 8.0. It is rapidly inactivated in highly acidic environments, making the pairing of pancreatic lipase with a pH of 2.0 incorrect.

147. (B) It increases solid fat content and shelf-life, but generates trans fats linked to cardiovascular risk.
Substituting liquid vegetable oils with partially hydrogenated fats improves the texture, melting profile, and shelf-life of processed foods by converting liquid unsaturated lipids into semi-solid fats. However, this industrial chemical process generates trans fatty acids as a byproduct, which are clinically linked to an increased risk of

cardiovascular disease by elevating low-density lipoprotein levels.

148. (D) The physical entrapment of starch within intact cell structures like whole grains.
The physical entrapment of starch within intact plant cell walls, as seen in whole grains and legumes, acts as a physical barrier that restricts the access of digestive amylases. This structural barrier significantly slows the rate of starch gelatinization and subsequent enzymatic hydrolysis, resulting in a slower release of glucose and a lower Glycaemic Index.

149. (A) Chylomicrons are expelled from the enterocyte into the capillaries of the portal vein.
Chylomicrons are large lipoprotein assemblies synthesized in the enterocytes to package absorbed long-chain triglycerides. Because of their size, they cannot enter the tight capillaries of the portal vein directly; instead, they are exocytosed into the lacteals of the lymphatic system, bypassing the liver and entering systemic circulation through the thoracic duct, making the portal vein statement incorrect.

150. (C) The milligrams of KOH required to saponify 1 gram of fat, indicating fatty acid molecular weight.
The Saponification Number is defined as the milligrams of potassium hydroxide required to completely saponify exactly one gram of a fat or oil sample. This value is inversely proportional to the average molecular weight of the fatty acids present, as fats containing shorter chain fatty acids have more ester bonds per gram, requiring more base.

www.nodia.in

Downloaded from www.pdf.tube

CHAPTER 02

Micronutrients: Vitamins and Minerals

1. Consider the following statements regarding the classification of vitamins:
I. Vitamins are classified based on their solubility in water or lipid solvents.
II. Fat-soluble vitamins require bile salts for efficient intestinal absorption.
III. Water-soluble vitamins are heavily stored in the liver and adipose tissues.
IV. Vitamin C and the B-complex group belong to the water-soluble classification.
Which of the above statements is/are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

2. Which of the following is the most concentrated natural dietary source of preformed Vitamin A (retinol)?
(A) Fresh organic carrots
(B) Raw baby spinach
(C) Sweet potato tubers
(D) Halibut liver oil

3. Consider the following statements:
Statement I: The primary active form of Vitamin A responsible for the visual cycle is 11-cis-retinal.
Statement II: Rhodopsin is formed by the combination of 11-cis-retinal and the protein opsin in the rod cells of the retina.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

4. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Night blindness is often the earliest clinical symptom of Vitamin A deficiency.
Reason (R): Vitamin A deficiency prevents the adequate regeneration of rhodopsin in the rod cells required for vision in low-light conditions.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

5. Identify the incorrect statement regarding the functions of Vitamin A.
(A) It acts as a primary coenzyme in oxidative decarboxylation reactions during energy metabolism.
(B) It plays a crucial role in cellular differentiation and the maintenance of epithelial tissues.
(C) Retinoic acid actively functions as a steroid-like hormone to regulate nuclear gene expression.
(D) It is absolutely essential for sustaining normal reproductive function and embryonic development.

6. A pediatric patient presents with foamy, silvery-grey plaques on the bulbar conjunctiva near the cornea. Which specific dietary intervention is most appropriate for this condition?
(A) Supplementation with cholecalciferol
(B) Increased intake of ascorbic acid-rich citrus fruits
(C) Intramuscular injection of phylloquinone
(D) Administration of a massive dose of oral retinol

7. Match the chemical forms of Vitamin A in List I with their primary physiological roles in List II.
List I: (Chemical Forms of Vitamin A)
P. Retinol
Q. Retinal
R. Retinoic Acid
S. Beta-carotene
List II: (Primary Physiological Roles)
I. Regulation of gene transcription and cell differentiation

II. Antioxidant and provitamin precursor
III. Transport form in blood and primary storage form
IV. Active component of visual pigments
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II
(C) P-I, Q-II, R-III, S-IV
(D) P-III, Q-I, R-IV, S-II

8. All of the following are characteristics of fat-soluble vitamins, EXCEPT:
(A) They are absorbed into the lymphatic system via chylomicrons.
(B) They pose a higher risk of toxicity compared to water-soluble vitamins.
(C) They are readily excreted in the urine when intake exceeds requirement.
(D) They require carrier proteins for transport in the bloodstream.

9. Identify the correct pair regarding Vitamin A deficiency disorders.
(A) Bitot's spots – Hardening of the tympanic membrane
(B) Xerosis – Excessive tearing and lacrimal gland hypertrophy
(C) Nyctalopia – Abnormal photophobia during daylight
(D) Keratomalacia – Softening and necrosis of the cornea

10. Arrange the progressive clinical stages of xerophthalmia in the correct sequential order:
I. Corneal xerosis
II. Night blindness
III. Keratomalacia
IV. Conjunctival xerosis
Which of the above stages represents the correct progressive sequence?
(A) II, IV, I, III
(B) I, II, IV, III
(C) II, I, IV, III
(D) IV, II, I, III

11. A 4-year-old child from a marginalized community is admitted with severe protein-energy malnutrition and bilateral hazy corneas with upper-eyelid ulceration. The attending physician identifies a severe micronutrient deficiency. What is the immediate physiological consequence if left untreated?
(A) Acute development of systemic scurvy
(B) Irreversible permanent blindness
(C) Severe macrocytic megaloblastic anemia
(D) Chronic rickets and skeletal deformities

12. Which of the following defines a "provitamin"?
(A) A synthetic analogue of a vitamin used as a direct fortification agent in commercial food processing
(B) An inactive precursor compound that must be converted into the active vitamin within the body
(C) A structural antagonist that actively competes with and inhibits the intestinal absorption of vitamins
(D) A degraded thermal byproduct that has lost its biological efficacy due to extreme heat processing

13. Which of the following describes the most likely effect of severe biliary obstruction on micronutrient status?
(A) Malabsorption and subsequent deficiency of vitamins A, D, E, and K
(B) Accelerated urinary excretion and rapid systemic depletion of B-complex vitamins
(C) Enhanced divalent metal transport and elevated absorption of non-heme iron
(D) Toxic accumulation and intracellular storage of ascorbic acid in hepatic tissues

14. Identify the incorrect pair regarding hypervitaminosis A (Vitamin A toxicity).
(A) Acute toxicity – Increased intracranial pressure and nausea
(B) Teratogenic effect – Spontaneous abortions and fetal malformations
(C) Carotenemia – Jaundice-like yellowing of the sclera (eyes)
(D) Chronic toxicity – Bone and joint pain, hepatomegaly

15. Which biochemical marker is considered the most reliable indicator of depleted Vitamin A stores before clinical symptoms appear?
(A) Serum alkaline phosphatase enzymatic activity levels
(B) Fasting venous blood glucose concentration measurements
(C) Elevated serum transferrin glycoprotein saturation percentage
(D) Serum retinol concentration falling below 20 μg/dL

Click Here to Buy book on Amazon

16. Consider the following statements about Vitamin D synthesis and metabolism:
I. 7-Dehydrocholesterol is converted to pre-vitamin D3 in the skin under UV-B radiation.
II. The first hydroxylation occurs in the liver to form 25-hydroxycholecalciferol.
III. The second hydroxylation occurs in the kidneys to form the active hormone 1,25-dihydroxycholecalciferol.
IV. Calcitonin stimulates the final conversion step in the kidneys.
Which of the above statements is/are correct?
(A) I, II, and IV
(B) II, III, and IV
(C) I, II, and III
(D) I, III, and IV

17. Which of the following represents the most well-established primary biochemical function of Vitamin E in the human body?
(A) Serving as an essential coenzyme for enzymatic transamination of amino acids
(B) Acting as a chain-breaking lipid-soluble antioxidant in cell membranes
(C) Facilitating the active physiological absorption of calcium in intestinal walls
(D) Promoting the primary hepatic synthesis of vitamin K-dependent clotting factors

18. Vitamin K is essential for the post-translational gamma-carboxylation of glutamic acid residues in which of the following blood clotting factors?
(A) Factors I, III, V, and VIII
(B) Factors XI, XII, and XIII
(C) Factors VIII and von Willebrand factor
(D) Factors II, VII, IX, and X

19. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Individuals living in high-latitude regions are at a greater risk of Vitamin D deficiency during winter months.
Reason (R): The zenith angle of the sun at high latitudes during winter scatters UV-B rays, preventing sufficient dermal synthesis of cholecalciferol.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

20. Consider the following statements:
Statement I: Tocopherols possess a saturated phytyl side chain, whereas tocotrienols possess an unsaturated side chain with three double bonds.
Statement II: Alpha-tocopherol is the most biologically active form of Vitamin E in humans.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

21. A patient on chronic warfarin therapy is counseled by a dietician regarding their dietary habits. What is the most appropriate advice concerning their intake of Vitamin K-rich foods like spinach and kale?
(A) Maintain a consistent daily intake of Vitamin K-rich foods to prevent fluctuations in drug efficacy.
(B) Completely eliminate all dietary Vitamin K sources to avoid interfering with the therapeutic blood-thinning effect.
(C) Consume highly erratic and variable portions of green leafy vegetables without consulting clinical teams.
(D) Double the total ingestion of dark green vegetables immediately after taking each prescribed pharmaceutical dose.

22. Match the fat-soluble vitamins in List I with their primary deficiency manifestations in List II.
List I: (Vitamins)
P. Vitamin D (Children)
Q. Vitamin D (Adults)
R. Vitamin E
S. Vitamin K
List II: (Deficiency Manifestations)
I. Osteomalacia
II. Hemorrhagic disease
III. Rickets
IV. Erythrocyte hemolysis
(A) P-I, Q-III, R-II, S-IV
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-I, R-II, S-III
(D) P-III, Q-I, R-IV, S-II

NODIA

23. Identify the incorrect pair relating a vitamin to its chemical name.
(A) Vitamin D2 – Ergocalciferol
(B) Vitamin K1 – Menaquinone
(C) Vitamin D3 – Cholecalciferol
(D) Vitamin E – Alpha-tocopherol

24. All of the following are physiological effects of calcitriol (1,25-dihydroxycholecalciferol) aimed at increasing serum calcium levels, EXCEPT:
(A) Increasing calcium absorption in the intestine
(B) Stimulating the mobilization of calcium from bone
(C) Decreasing the intestinal absorption of dietary phosphorus
(D) Increasing the reabsorption of calcium in the renal distal tubules

25. Premature infants placed in oxygen-rich incubators sometimes develop hemolytic anemia. This is primarily attributed to increased oxidative stress coupled with poor placental transfer of which specific micronutrient?
(A) Vitamin B12
(B) Vitamin K
(C) Vitamin D
(D) Vitamin E

26. Which statement correctly distinguishes between rickets and osteomalacia?
(A) Rickets involves defective mineralization of growing bone cartilage, whereas osteomalacia involves demineralization of adult bone.
(B) Rickets occurs exclusively after the fusion of epiphyseal plates in adults, while osteomalacia occurs prior to plate closure.
(C) Rickets is caused by chronic dietary Vitamin E deficiency, whereas osteomalacia is caused strictly by Vitamin D deficiency.
(D) Rickets primarily results in extremely brittle bones prone to fracture, while osteomalacia results solely in skeletal bowing.

27. Which of the following provides the most accurate definition of cholecalciferol?
(A) A highly hydrophilic water-soluble vitamin precursor derived primarily from plant sterols
(B) The naturally occurring animal form of Vitamin D synthesized in the skin (Vitamin D3)
(C) An ergosterol-derived plant form of Vitamin D consumed via sun-exposed mushrooms (Vitamin D2)
(D) The fully active hormonal compound of Vitamin D converted through renal hydroxylation

28. Which mechanism best explains why patients with severe liver cirrhosis frequently develop a secondary Vitamin K deficiency?
(A) The liver increases metabolic clearance and rapidly degrades Vitamin K into inactive polar metabolites.
(B) Impaired bile production leads to defective micelle formation and fat-soluble vitamin malabsorption.
(C) The hepatic cells secrete excessive levels of structural antagonists that actively block target receptors.
(D) Advanced biliary tract obstruction causes excessive accelerated urinary excretion of phylloquinone compounds.

NODIA

29. Identify the correct pair regarding vitamins and their functional coenzyme/active forms.
(A) Vitamin B2 – Flavin adenine dinucleotide
(B) Vitamin B1 – Pyridoxal phosphate
(C) Vitamin B3 – Thiamine pyrophosphate
(D) Vitamin B6 – Nicotinamide adenine dinucleotide

30. An 80-year-old homebound individual presents with deep bone pain, proximal muscle weakness, and a waddling gait. Laboratory tests reveal low serum calcium and elevated parathyroid hormone (PTH) levels. Which condition is most strongly indicated?
(A) Senile osteoporosis driven by age-related decline in bone mass
(B) Paget's disease of the bone involving disorganized remodeling
(C) Osteomalacia resulting from chronic systemic Vitamin D deficiency
(D) Clinical scurvy triggered by prolonged severe Vitamin C deficiency

31. Consider the following statements about B-complex vitamins:
I. Thiamine is converted to TPP, which is essential for the pyruvate dehydrogenase complex.
II. Riboflavin forms FAD and FMN, crucial for mitochondrial electron transport.
III. Niacin forms NAD+ and NADP+, functioning in hydride transfer reactions.

IV. Pyridoxine acts as a coenzyme exclusively in carbohydrate metabolism.

Which of the above statements is/are correct?
(A) I, III, and IV
(B) II, III, and IV
(C) I, II, and IV
(D) I, II, and III

32. What is the only dietary source of naturally occurring cobalamin (Vitamin B12) for humans?
(A) Dark green leafy vegetables
(B) Citrus fruits
(C) Animal-derived foods
(D) Unmilled cereals and whole grains

33. Consider the following statements:
Statement I: Ascorbic acid functions as a potent water-soluble reducing agent and antioxidant by donating electrons.
Statement II: The structure of L-ascorbic acid resembles that of glucose, and it can be synthesized by humans from glucose derivatives.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

34. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Mandatory fortification of cereal grain products with folic acid has been implemented in many countries.
Reason (R): Folic acid supplementation in the periconceptional period significantly reduces the incidence of neural tube defects like spina bifida.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

35. Identify the incorrect statement regarding Riboflavin (Vitamin B2).
(A) It functions as the specific carrier of methyl groups in homocysteine metabolism.
(B) It imparts a characteristic fluorescent yellow-green color to milk whey.
(C) Its deficiency typically presents as cheilosis, angular stomatitis, and glossitis.
(D) It is highly sensitive to destruction by ultraviolet (UV) light.

36. A population heavily reliant on untreated maize (corn) as their staple food develops a disease characterized by dermatitis, diarrhea, and dementia. This condition is due to the poor bioavailability of which vitamin in maize?
(A) Thiamine
(B) Folate
(C) Niacin
(D) Biotin

37. Match the B-complex vitamins in List I with their respective coenzymes in List II.
List I: (B-Complex Vitamins)
P. Pantothenic acid
Q. Biotin
R. Vitamin B6
S. Folic acid
List II: (Coenzymes)
I. Pyridoxal 5'-phosphate (PLP)
II. Tetrahydrofolate (THF)
III. Coenzyme A (CoA)
IV. Biocytin
(A) P-III, Q-IV, R-I, S-II
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-III, Q-I, R-IV, S-II

38. All of the following are generally true regarding the storage of water-soluble vitamins in the human body, EXCEPT:
(A) They are readily excreted in the urine, requiring regular dietary intake.
(B) Tissue stores are rapidly depleted, often within weeks, if deficient in the diet.
(C) Vitamin B12 is uniquely stored in the liver in quantities sufficient for several years.
(D) High doses of Vitamin C are stored extensively in adipose tissue for long-term use.

39. Identify the correct pair relating a B vitamin to its classical deficiency disease.
(A) Thiamine – Infantile and adult scurvy
(B) Vitamin B12 – Classic pernicious anemia
(C) Niacin – Dry and wet systemic beriberi
(D) Riboflavin – Severe clinical pellagra

Downloaded from www.pdf.tube

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

40. Arrange the progression of clinical symptoms associated with scurvy (Vitamin C deficiency) in the typical sequence of manifestation:
I. Petechiae and bleeding gums
II. Decreased tissue saturation of ascorbic acid
III. Sudden death due to cardiac failure or massive hemorrhage
IV. Impaired wound healing and joint pain
Which of the following represents the correct progressive sequence?
(A) I, II, IV, III
(B) II, IV, I, III
(C) II, I, IV, III
(D) IV, I, II, III

41. A strict vegan presents with fatigue, tingling sensations in the extremities, and glossitis. A complete blood count reveals macrocytic erythrocytes. Which specific deficiency is the most probable cause of both the hematological and neurological symptoms?
(A) Folic acid deficiency
(B) Iron deficiency
(C) Pyridoxine deficiency
(D) Vitamin B12 deficiency

42. Which is the most precise biochemical definition of ascorbic acid's role in collagen synthesis?
(A) It functions as a reducing agent to maintain iron in the ferrous (Fe^{2+}) state for prolyl and lysyl hydroxylases.
(B) It incorporates directly as an essential mechanical structural component within the triple helix polypeptide of collagen.
(C) It activates critical nuclear transcription factors that regulate the intracellular expression of procollagen genes.
(D) It acts as a highly specialized extracellular chaperone carrier protein that guides the self-assembly of collagen fibrils.

43. Which of the following cause-effect relationships correctly explains the pathophysiology of Wernicke-Korsakoff syndrome in chronic alcoholics?
(A) Alcohol toxicity destroys intrinsic factor, leading to B12 malabsorption and subsequent demyelination.
(B) Alcohol interferes with thiamine absorption and utilization, causing severe neuronal energy deficit.
(C) Ethanol directly degrades pyridoxine in the liver, leading to neurotransmitter imbalance.
(D) Chronic alcohol intake promotes the rapid excretion of Vitamin C, weakening the blood-brain barrier.

44. Identify the incorrect pair regarding the numerical designation of B-complex vitamins.
(A) Vitamin B1 – Thiamine
(B) Vitamin B5 – Pyridoxine
(C) Vitamin B2 – Riboflavin
(D) Vitamin B7 – Biotin

45. Which combination of preparation methods is recommended to maximize the retention of Vitamin C in vegetables?
(A) Steaming or microwaving whole or large pieces with minimal water
(B) Finely chopping and prolonged boiling in large volumes of water
(C) Addition of baking soda to cooking water to preserve green color
(D) Searing at extremely high temperatures followed by slow simmering

46. Consider the following statements regarding the stability of vitamins during food processing:
I. Ascorbic acid is easily oxidized in the presence of heat, light, and alkaline pH.
II. Fat-soluble vitamins are highly susceptible to leaching into cooking water.
III. Thiamine is particularly vulnerable to destruction by sulfites used as food preservatives.
IV. Niacin is considered one of the most stable vitamins and withstands typical cooking temperatures well.
Which of the above statements is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

47. Which of the following vitamins is generally considered the most unstable and heat-labile during typical thermal food processing and storage?
(A) Cholecalciferol
(B) Nicotinic acid
(C) Phylloquinone
(D) Ascorbic acid

48. By definition, a "trace element" (micromineral) is a mineral that the human body requires in amounts generally less than:

NODIA

(A) 1000 mg per day
(B) 500 mg per day
(C) 100 mg per day
(D) 1 mg per day

49. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Fluid milk should ideally be packaged in opaque plastic or cardboard containers rather than clear glass bottles.
Reason (R): Exposure to ambient or fluorescent light rapidly degrades the riboflavin content in milk.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

50. Consider the following statements:
Statement I: Blanching vegetables prior to freezing inactivates enzymes like ascorbic acid oxidase, which helps preserve Vitamin C during frozen storage.
Statement II: The blanching process itself causes zero loss of water-soluble vitamins.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

51. For a fortified transparent beverage containing added Vitamin B2 and Vitamin A, which protective packaging feature is most scientifically justified?
(A) A UV and visible light-blocking amber or opaque sleeve
(B) Permeability to oxygen to prevent anaerobic fermentation
(C) A desiccant pouch to remove moisture
(D) Micro-perforations to allow ethylene gas to escape

52. Match the vitamins in List I with the processing agent or condition most likely to cause their destruction in List II.
List I: (Vitamins)
P. Vitamin C
Q. Vitamin B1 (Thiamine)
R. Vitamin B2 (Riboflavin)
S. Vitamin E
List II: (Destruction Conditions)
I. Visible and Ultraviolet Light
II. Lipid oxidation (Rancidity)
III. Alkaline environment and oxidation
IV. Sulfite treatment and prolonged neutral heat
(A) P-IV, Q-III, R-II, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-IV, R-I, S-II
(D) P-III, Q-I, R-IV, S-II

53. Identify the incorrect pair regarding the classification of minerals.
(A) Magnesium – Micromineral
(B) Calcium – Macromineral
(C) Iron – Micromineral
(D) Phosphorus – Macromineral

54. All of the following are classified as essential macrominerals (major minerals) in the human diet, EXCEPT:
(A) Potassium
(B) Sulfur
(C) Sodium
(D) Zinc

55. High-temperature short-time (HTST) extrusion cooking is widely used for breakfast cereals. Which chemical mechanism primarily explains the loss of lysine and certain B-vitamins during this specific process?
(A) Hydrolytic rancidity
(B) Maillard reaction
(C) Enzymatic browning
(D) Saponification

56. Which statement most accurately describes the phenomenon of "leaching" in relation to food preparation?
(A) The breakdown of vitamins due to high-intensity light exposure.
(B) The irreversible binding of minerals to dietary fiber in the intestine.
(C) The extraction and loss of water-soluble nutrients into the cooking liquid.
(D) The conversion of provitamins into their active forms through thermal energy.

Click Here to Buy book on Amazon

57. Which is the most accurate definition of a "micromineral" in nutritional science?
(A) An organic coenzyme precursor compound that catalyzes intracellular chemical processes in extremely tiny trace amounts.
(B) A mineral component synthesized exclusively by microscopic bacterial and fungal flora located deep within agricultural soils.
(C) Any naturally occurring element that currently lacks a formally established, globally recognized Recommended Dietary Allowance.
(D) An inorganic element essential to human health that represents less than 0.01% of total body weight.

58. Which cause-effect relationship regarding food additives is correct?
(A) Treatment of dried fruits with sulfur dioxide specifically cleaves and destroys the thiamine molecule.
(B) Preservation with sodium benzoate systematically induces the direct chemical precipitation of free calcium in citrus juices.
(C) Addition of synthetic L-ascorbic acid actively oxidizes and completely destroys endogenous tocopherols like Vitamin E.
(D) Direct application of nitrites in cured meat products significantly enhances the physiological absorption of non-heme iron.

59. Identify the correct pair associating a processing method with its typical nutrient retention characteristic.
(A) Milling of whole grain wheat to white flour – Induces exceptional retention of the original dietary B-complex vitamins
(B) UHT processing of milk – Superior retention of water-soluble vitamins compared to prolonged boiling
(C) Traditional sun-drying of fresh organic fruits – Leads to complete conservation and zero degradation of unstable Vitamin C
(D) Industrial canning of fresh green vegetables – Results in the total, absolute elimination of endogenous sodium content

60. A comparative analysis is performed on raw milk, pasteurized milk, and UHT (Ultra-High Temperature) treated milk. Which vitamin will show the most significant percentage loss in the UHT milk compared to the raw milk?
(A) Vitamin A
(B) Vitamin C
(C) Vitamin D
(D) Calcium

61. Consider the following statements regarding the physiological functions of calcium:
I. It is the primary mineral component of hydroxyapatite in bones and teeth.
II. It acts as an intracellular secondary messenger in signal transduction.
III. It is required for the release of neurotransmitters at synaptic junctions.
IV. It acts as an oxygen-carrying moiety in myoglobin.
Which of the above statements is/are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

62. Which of the following foods provides the most bioavailable form of dietary iron (heme iron)?
(A) Spinach
(B) Fortified breakfast cereal
(C) Red meat (beef)
(D) Lentils

63. Consider the following statements:
Statement I: Concurrent consumption of Vitamin C enhances the intestinal absorption of non-heme iron.
Statement II: Vitamin C reduces ferric iron (Fe^{3+}) to ferrous iron (Fe^{2+}), which remains more soluble at the alkaline pH of the duodenum.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

64. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Diets excessively high in unrefined cereals and legumes can precipitate calcium and iron deficiencies.
Reason (R): Phytic acid (phytate) present in the bran of grains forms insoluble, indigestible complexes with divalent cations like calcium,

NODIA

iron, and zinc.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

65. Identify the incorrect statement regarding the functions of phosphorus in the body.
(A) It is a structural component of DNA and RNA backbones.
(B) It plays a primary role in the initiation of the blood coagulation cascade.
(C) It forms the high-energy bonds in ATP and creatine phosphate.
(D) It functions as a major intracellular buffer to maintain acid-base balance.

66. A young woman with a habit of drinking strong black tea immediately after every meal presents with pallor, fatigue, and koilonychia (spoon-shaped nails). The tea consumption is most likely interfering with the absorption of which specific nutrient?
(A) Calcium
(B) Vitamin B12
(C) Ascorbic acid
(D) Non-heme iron

67. Match the minerals in List I with their associated deficiency or toxicity conditions in List II.
List I: (Minerals)
P. Calcium
Q. Iron (Deficiency)
R. Iron (Toxicity)
S. Phosphorus
List II: (Associated Conditions)
I. Hypophosphatemic rickets
II. Tetany
III. Hemochromatosis
IV. Microcytic hypochromic anemia
(A) P-II, Q-IV, R-III, S-I
(B) P-I, Q-III, R-IV, S-II
(C) P-II, Q-III, R-IV, S-I
(D) P-IV, Q-II, R-I, S-III

68. All of the following dietary components are known to inhibit the absorption of non-heme iron, EXCEPT:
(A) Tannins present in black tea and roasted coffee beans
(B) Oxalic acid compounds located in fresh raw spinach leaves
(C) Meat, Fish, and Poultry (MFP) factor in animal tissues
(D) Phytic acid reserves found in raw unrefined whole grains

69. Identify the correct pair regarding iron metabolism proteins.
(A) Hepcidin – Central regulatory hormone that inhibits iron efflux into the blood
(B) Ferritin – Plasma glycoprotein that actively transports free ferric iron in the blood circulation
(C) Transferrin – Primary intracellular protein complex that stores iron inside hepatic parenchymal cells
(D) Ceruloplasmin – Luminal ligand that binds free gastric iron to completely prevent oxidative mucosal damage

70. Arrange the progressive stages of iron deficiency in the correct physiological sequence:
I. Iron deficiency anemia (decline in hemoglobin levels)
II. Depletion of iron stores (decreased serum ferritin)
III. Iron-deficient erythropoiesis (decreased transferrin saturation)
IV. Microcytosis and hypochromia of red blood cells
Which of the following represents the correct progressive sequence?
(A) I, II, III, IV
(B) III, II, IV, I
(C) II, I, III, IV
(D) II, III, I, IV

71. A pregnant woman in her second trimester reports an intense craving to consume non-food substances such as clay and chalk (pica). She also complains of severe lethargy. These clinical signs are most classically associated with a deficiency of:
(A) Calcium
(B) Iron
(C) Folic acid
(D) Zinc

72. Which is the accurate definition of transferrin?
(A) The main intracellular iron-storage macromolecule located primarily in the parenchymal cells of the liver and spleen.
(B) The duodenal brush-border enzyme

Downloaded from www.pdf.tube

responsible for reducing insoluble ferric iron to soluble ferrous iron in the enterocyte.
(C) The glycoprotein synthesized in the liver that binds and transports ferric iron (Fe^{3+}) in the blood.
(D) The specific membrane-bound receptor protein on target macrophages that selectively engulfs senescent red blood cells.

73. Which of the following best describes the cause-effect relationship of an excessively high dietary phosphorus-to-calcium ratio?
(A) It directly stimulates the hyper-absorption of active calcium ions from the brush-border membrane of the intestine.
(B) It causes the rapid chemical precipitation of calcium phosphate minerals in the alveolar capillary beds of the lungs.
(C) It biochemically inhibits the direct synthesis of calcitonin, rapidly leading to the development of acute hypercalcemia.
(D) It leads to transient hypocalcemia, triggering PTH release and subsequent bone demineralization.

74. Identify the incorrect pair regarding minerals and their primary regulatory hormones.
(A) Iron – Calcitonin
(B) Calcium – Parathyroid hormone (PTH)
(C) Sodium – Aldosterone
(D) Potassium – Insulin (influences cellular shift)

75. A food manufacturer wishes to fortify a high-phytate infant cereal with iron. To ensure maximum bioavailability and safety, which chemical form of iron and accompanying additive would be the most competent choice?
(A) Ferric chloride with sodium bicarbonate
(B) Ferrous sulfate with L-ascorbic acid
(C) Elemental iron powder with calcium carbonate
(D) Ferrous gluconate with black tea extract

76. Consider the following statements regarding the functions of zinc in the human body:
I. It is an essential structural component of "zinc finger" motifs in DNA-binding proteins.
II. It acts as a cofactor for over 300 metalloenzymes, including carbonic anhydrase and alcohol dehydrogenase.
III. It plays a critical role in wound healing and immune function.
IV. It is the central atom in the porphyrin ring of the hemoglobin molecule.
Which of the above statements is/are correct?
(A) I, III, and IV
(B) I, II, and III
(C) II, III, and IV
(D) I, II, and IV

NODIA

77. Severe iodine deficiency during the early stages of pregnancy is most definitively associated with which irreversible condition in the offspring?
(A) Cretinism (congenital hypothyroidism)
(B) Spina bifida (myelomeningocele)
(C) Macrosomia (infantile gigantism)
(D) Osteogenesis imperfecta (fragile bone disease)

78. Which protein is primarily responsible for the transport of copper in the blood plasma and also acts as a ferroxidase essential for iron mobilization?
(A) Metallothionein
(B) Albumin
(C) Ceruloplasmin
(D) Transcobalamin

79. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Populations consuming diets heavily dependent on raw cassava and cabbage have a higher prevalence of endemic goiter.
Reason (R): These foods contain goitrogens (like cyanogenic glycosides and glucosinolates) that interfere with the thyroid gland's uptake of iodine.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

80. Consider the following statements:
Statement I: Manganese acts as a critical cofactor for the mitochondrial enzyme superoxide dismutase (MnSOD), which neutralizes free radicals.
Statement II: Manganese is a macromineral required in amounts exceeding 1000 mg per day.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.

(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

81. Which biochemical measurement provides the most practical and sensitive indicator of recent community iodine status in a school-aged population?
(A) Serum Thyroid Stimulating Hormone (TSH)
(B) Median urinary iodine concentration (UIC)
(C) Serum thyroxine (T4) levels
(D) Radioactive iodine uptake test

82. Match the trace minerals in List I with their specific metalloenzymes or functional proteins in List II.
List I: (Trace Minerals)
P. Zinc
Q. Copper
R. Manganese
S. Iodine
List II: (Metalloenzymes or Functional Proteins)
I. Cytochrome c oxidase
II. Carbonic anhydrase
III. Pyruvate carboxylase
IV. Thyroglobulin
(A) P-I, Q-II, R-IV, S-III
(B) P-III, Q-IV, R-I, S-II
(C) P-II, Q-III, R-I, S-IV
(D) P-II, Q-I, R-III, S-IV

83. Identify the incorrect pair regarding trace element deficiencies and their clinical signs.
(A) Copper – Wilson's disease
(B) Zinc – Growth retardation and delayed sexual maturation
(C) Iodine – Goiter
(D) Iron – Microcytic hypochromic anemia

84. All of the following are considered excellent dietary sources of highly bioavailable zinc, EXCEPT:
(A) Oysters and shellfish
(B) Beef and red meats
(C) Refined polished rice
(D) Poultry

85. A pediatric patient presents with sparse, kinky hair, failure to thrive, and severe neurological deterioration. Blood tests reveal profoundly low levels of serum copper and ceruloplasmin. This presentation is characteristic of a genetic defect in copper absorption known as:
(A) Menkes disease
(B) Hemochromatosis
(C) Wilson's disease
(D) Acrodermatitis enteropathica

86. Which statement correctly describes the interaction between dietary zinc and phytates?
(A) Phytates serve as active digestive enzymes that cleave zinc from dietary proteins, substantially enhancing its overall bioavailability.
(B) Intestinal zinc absorption kinetics are completely and entirely unaffected by the presence of any phytates or dietary fiber in the diet.
(C) Phytates actively stimulate the intracellular synthesis of metallothionein, which transport zinc ions directly across the enterocyte.
(D) Phytates act as chelating agents that tightly bind zinc in the intestinal lumen, significantly decreasing its absorption.

87. What is the standard clinical definition of cretinism in the context of mineral deficiency?
(A) A localized, benign enlargement of the follicular cells of the thyroid gland triggered specifically by chronic dietary iron deficiency.
(B) A syndrome of severe physical and mental retardation resulting from maternal iodine deficiency during fetal development.
(C) A systemic childhood condition of fragile, porous cortical bones resulting from accelerated peak calcium depletion in early infancy.
(D) A severe, genetic dermatological condition characterized by desquamative skin plaques caused by an inability to absorb dietary zinc.

88. Which cause-effect mechanism accurately explains the pathology of Acrodermatitis enteropathica?
(A) Autoantibodies destroy the thyroid gland, resulting in an inability to utilize dietary iodine.
(B) Excessive dietary copper displaces zinc from its carrier proteins, causing a functional zinc deficiency.
(C) A genetic mutation impairs the intestinal ZIP4 transporter, causing severe systemic zinc deficiency.

Click Here to Buy book on Amazon

(D) A defect in transferrin synthesis prevents iron delivery to the skin, causing severe dermatitis.

89. Identify the correct pair associating a trace mineral with its primary storage or concentration site in the human body.
(A) Iodine – Follicular cells of the pancreas
(B) Iron – Mineralized matrix of the bone cortex
(C) Copper – Subcutaneous white adipose tissue
(D) Zinc – Male prostate gland and ocular tissues

90. A patient reports a significant reduction in their ability to taste food (hypogeusia) and notes that minor cuts are taking an unusually long time to heal. These symptoms point strongly toward a deficiency in which trace mineral?
(A) Zinc
(B) Selenium
(C) Manganese
(D) Chromium

91. Consider the following statements regarding sodium and potassium:
I. Sodium is the primary extracellular cation, while potassium is the primary intracellular cation.
II. The Na+/K+ ATPase pump actively maintains the concentration gradients of these ions across cell membranes.
III. Both minerals are critical for the generation and propagation of action potentials in nerve and muscle cells.
IV. High dietary potassium intake is strongly associated with an increased risk of hypertension.
Which of the above statements is/are correct?
(A) I, II, and IV
(B) I, II, and III
(C) II, III, and IV
(D) I, III, and IV

92. Selenium exerts its primary antioxidant function as an essential component of which specific enzyme?
(A) Catalase
(B) Glutathione peroxidase
(C) Superoxide dismutase
(D) Cytochrome P450

93. Consider the following statements:
Statement I: Systemic and topical fluoride incorporation into tooth enamel substitutes hydroxyl ions to form fluoroapatite, which is more resistant to acid decay.
Statement II: Fluoride is an essential macromineral required in amounts exceeding 100 mg per day to maintain bone density.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

94. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Excessive dietary sodium intake is a major modifiable risk factor for the development of essential hypertension.
Reason (R): High sodium levels cause water retention to maintain extracellular fluid osmolality, thereby increasing blood volume and cardiac output.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

95. Identify the incorrect statement regarding the biological role of chromium.
(A) Trivalent chromium (Cr^{3+}) is the biologically active form found in foods.
(B) Hexavalent chromium (Cr^{6+}) is highly toxic and a known carcinogen.
(C) It is believed to potentiate the action of insulin by forming a complex called chromodulin.
(D) Chromium functions as an integral structural component of the thyroid hormones.

96. In the formulation of Oral Rehydration Salts (ORS) for the treatment of severe diarrheal dehydration, why is glucose included alongside sodium?
(A) Glucose acts as a metabolic preservative designed to actively inhibit opportunistic bacterial growth in the prepared oral solution.
(B) Glucose provides a highly palatable sweet

Downloaded from www.pdf.tube

taste profile, thereby encouraging consistent, voluntary consumption by young pediatric patients.

(C) Glucose and sodium are co-transported across the intestinal epithelium via the SGLT1 transporter, maximizing water absorption.

(D) Glucose actively lowers the pH of the distal gastrointestinal tract, directly killing pathogens like Vibrio cholerae upon contact.

97. Match the minerals in List I with their specific physiological functions in List II.

List I: (Minerals)

P. Selenium

Q. Fluoride

R. Chromium

S. Sodium

List II: (Physiological Functions)

I. Potentiation of insulin action

II. Prevention of dental caries

III. Maintenance of extracellular fluid volume

IV. Reduction of lipid hydroperoxides via glutathione peroxidase

(A) P-I, Q-III, R-IV, S-II

(B) P-IV, Q-II, R-I, S-III

(C) P-IV, Q-I, R-II, S-III

(D) P-II, Q-IV, R-III, S-I

98. All of the following are generally considered excellent dietary sources of potassium, EXCEPT:

(A) Bananas

(B) Potatoes

(C) Oranges and citrus juices

(D) Highly processed refined meats

99. Identify the correct pair regarding fluoride toxicity.

(A) Mild dental fluorosis – Chalky white mottling or pitting of the enamel

(B) Acute toxicity – Osteoporosis and bone fractures

(C) Skeletal fluorosis – Increased joint flexibility and muscle atrophy

(D) Endemic fluorosis – Caused by severe fluoride deficiency in groundwater

100. Arrange the sequence of physiological events in the Renin-Angiotensin-Aldosterone System (RAAS) triggered by low blood sodium:

I. Aldosterone stimulates sodium reabsorption in the renal distal tubules.

II. Renin is secreted by the juxtaglomerular apparatus of the kidneys.

III. Angiotensin-converting enzyme (ACE) converts Angiotensin I to Angiotensin II.

IV. Renin converts angiotensinogen to Angiotensin I.

Which of the following represents the correct sequence of events?

(A) IV, II, III, I

(B) II, III, IV, I

(C) II, IV, III, I

(D) III, II, I, IV

NODIA

101. An endurance athlete collapses after completing a marathon in hot conditions. They had consumed large quantities of plain water during the race. They are experiencing severe muscle cramps, weakness, and confusion. Blood tests reveal severe hypokalemia and hyponatremia. This condition is primarily a result of:

(A) Profound physiological loss of key electrolytes through sweat accompanied by excessive plain water ingestion.

(B) Acute metabolic toxicity arising from rapid overconsumption of concentrated carbohydrate gels.

(C) Sudden, uncontrolled hormonal mobilization of stored calcium minerals from the cortical skeletal system.

(D) Massive systemic destruction of circulating red blood cells, directly leading to severe acute hyperkalemia.

102. Which is the correct definition of Keshan disease?

(A) An endemic enlargement of the thyroid gland prevalent among populations living in high-altitude regions with low soil iodine.

(B) A chronic neurological disorder caused by excessive, toxic accumulation of industrial manganese within the basal ganglia cells.

(C) A severe, painful, and highly inflammatory form of enteropathic, zinc-responsive desquamative dermatitis in young infants.

(D) A potentially fatal cardiomyopathy occurring primarily in children and young women, associated with severe selenium deficiency.

103. Which cause-effect relationship involving chromium is hypothesized in human metabolism?

(A) Severe dietary chromium deficiency directly blocks glycogen synthesis, triggering massive compensatory pancreatic overproduction of insulin and subsequent fatal hypoglycemia.

(B) Adequate chromium intake enhances the

binding of insulin to its receptor, thereby improving intracellular glucose uptake and mitigating insulin resistance.
(C) Elevated intake of hexavalent chromium compounds in standard diets actively stimulates damaged pancreatic beta-islet cells to rapidly proliferate and regenerate.
(D) Trivalent chromium forms stable luminal complexes that completely block the enzymatic hydrolysis and mucosal absorption of all complex carbohydrates in the small intestine.

104. Identify the incorrect pair linking an electrolyte to its primary fluid compartment dominance.
(A) Sodium – Extracellular fluid
(B) Chloride – Extracellular fluid
(C) Calcium – Intracellular fluid
(D) Potassium – Intracellular fluid

105. In developing a low-sodium salt substitute for hypertensive patients to maintain the salty flavor profile, replacing sodium chloride with which compound is the most standard commercial practice?
(A) Calcium chloride
(B) Magnesium sulfate
(C) Ammonium chloride
(D) Potassium chloride

106. Consider the following statements regarding the factors affecting mineral bioavailability:
I. Gastric acidity (low pH) generally improves the solubility and absorption of minerals like calcium and iron.
II. Aging is often associated with a decrease in gastric acid secretion, which can reduce mineral absorption.
III. The physiological need of the body dictates absorption rates; iron absorption increases significantly during deficiency.
IV. High intake of dietary fiber universally enhances the absorption of all trace minerals.
Which of the above statements is/are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

107. What is the primary public health objective of a mass food fortification program?
(A) To rapidly cure specific hospitalized individuals who exhibit acute, severe, life-threatening clinical symptoms of a major nutrient deficiency.
(B) To increase the nutritional value of a staple food to prevent specific micronutrient deficiencies in the general population.
(C) To dramatically alter the flavor profiles, colorants, and physical sensory characteristics of highly processed foods to increase mass consumer appeal.
(D) To economically substitute the entirety of natural nutrient content lost during thermal manufacturing with cheaper, highly stable synthetic alternatives.

108. Which of the following is the most universally utilized and effective food vehicle for the fortification of Vitamin D?
(A) Refined wheat flour
(B) Fluid cow's milk
(C) Table salt
(D) Granulated sugar

109. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): The calcium present in spinach has a very low bioavailability compared to the calcium in milk.
Reason (R): Spinach contains high levels of oxalic acid, which chelates calcium to form insoluble calcium oxalate, preventing its absorption in the human gut.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

110. Consider the following statements:
Statement I: Prolonged, high-dose zinc supplementation can lead to a secondary copper deficiency.
Statement II: High luminal zinc levels stimulate the synthesis of metallothionein in enterocytes, which has a higher affinity for copper, trapping it inside the cell until it is sloughed off.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is

Click Here to Buy book on Amazon

incorrect.
(D) Statement I is incorrect but Statement II is correct.

111. Designing a Double Fortified Salt (DFS) requires overcoming chemical incompatibilities between the added nutrients. Which two specific micronutrients are combined in DFS formulations commonly used in India?
(A) Calcium and Vitamin D
(B) Zinc and Vitamin A
(C) Folic acid and Vitamin B12
(D) Iron and Iodine

112. Match the dietary factors in List I with their effect on mineral absorption in List II.
List I: (Dietary Factors)
P. Vitamin C
Q. Phytic Acid
R. Vitamin D
S. Tannins
List II: (Effects on Mineral Absorption)
I. Inhibits non-heme iron absorption
II. Enhances calcium absorption
III. Enhances non-heme iron absorption
IV. Inhibits absorption of zinc, iron, and calcium
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-I, R-II, S-III
(C) P-III, Q-IV, R-II, S-I
(D) P-III, Q-II, R-IV, S-I

113. Identify the incorrect pair regarding nutrient addition terminology.
(A) Enrichment – Adding back nutrients that were lost during food processing (e.g., adding B vitamins back to white flour).
(B) Restoration – Adding entirely new, unapproved synthetic vitamins to organic produce.
(C) Fortification – Adding nutrients that were not originally present or present in insignificant amounts (e.g., adding iodine to salt).
(D) Standardization – Adjusting the natural nutrient content to meet a specific regulatory level.

114. All of the following dietary compounds are known to inhibit the absorption of non-heme iron, EXCEPT:
(A) Polyphenols in black tea
(B) Calcium in dairy products
(C) Oxalic acid in dark leafy greens
(D) Citric acid in citrus fruits

115. When co-formulating an iron supplement pill with ascorbic acid to maximize absorption, what specific chemical interaction is leveraged?
(A) Ascorbic acid reduces Fe^{3+} to Fe^{2+}, which is the soluble form absorbed by the DMT1 transporter.
(B) Ascorbic acid oxidizes Fe^{2+} to Fe^{3+}, preventing it from binding to mucosal cells.
(C) Ascorbic acid neutralizes stomach acid, creating the optimal alkaline environment for iron uptake.
(D) Ascorbic acid binds to transferrin, facilitating iron transport in the blood.

NODIA

116. According to the Food Safety and Standards Authority of India (FSSAI) regulations on fortified foods, which statement is correct?
(A) Fortification of all staple foods is strictly voluntary and has no mandated standards.
(B) FSSAI prohibits the fortification of edible oil with fat-soluble vitamins.
(C) The "+F" logo is a mandatory declaration on the label of strictly regulated fortified foods.
(D) Fortification levels are designed to provide 100% of the RDA for all individuals regardless of diet.

117. Which is the most rigorous scientific definition of nutrient "bioavailability"?
(A) The proportion of an ingested nutrient that is absorbed, transported, and utilized by the body for metabolic functions.
(B) The absolute total concentration of a chemical element or vitamin compound present within a complex food matrix before ingestion.
(C) The precise kinetic dissolution speed at which a specific crystallized vitamin molecule completely dissolves in highly acidic gastric juice.
(D) The exact biochemical percentage of a dietary macro- or micromineral that is excreted completely unchanged in the feces.

118. Which of the following describes a known antagonistic cause-effect relationship between two minerals?
(A) Excessive intake of dietary iodine triggers hyperfiltration in renal glomeruli, causing rapid excretion of zinc in the urine.

(B) High chronic potassium intake alters systemic pH and directly forces calcium out of bones, causing immediate, severe osteoporosis.
(C) High sodium intake within the lumen of the gastrointestinal tract actively enhances the passive absorption of dietary magnesium in the colon.
(D) High dietary calcium intake concurrently consumed with iron-rich foods competitively inhibits iron absorption.

119. Identify the correct pair matching an FSSAI-regulated food vehicle with its legally targeted fortification nutrients in India.
(A) Edible Vegetable Oil – Highly stable synthetic thiamine (Vitamin B1) and riboflavin (Vitamin B2)
(B) Wheat Flour (Atta) – Iron, Folic Acid, and Vitamin B12
(C) Liquid Standardized Milk – Essential elemental iron, ferrous fumarate, and zinc oxide complexes
(D) Double Fortified Table Salt – Fat-soluble Vitamin A palmitate and active cholecalciferol (Vitamin D3)

120. What is the primary intended outcome used to measure the success of a mandatory flour fortification program with folic acid?
(A) Reduction in the prevalence of night blindness in children.
(B) Elimination of goiter in mountainous communities.
(C) Decrease in the incidence of neural tube defects (NTDs) in newborns.
(D) Improvement in bone mineral density among post-menopausal women.

121. Consider the following statements regarding the Recommended Dietary Allowance (RDA):
I. RDA is the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97.5%) healthy individuals in a particular life stage and gender group.
II. RDAs are established for nutrients where sufficient scientific evidence exists to determine an Estimated Average Requirement (EAR).
III. RDA values are universally identical across all countries and climates.
IV. RDA accounts for nutrient losses during normal cooking and processing.
Which of the above statements is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

122. Which of the following is a classic clinical manifestation of chronic Vitamin A toxicity (hypervitaminosis A)?
(A) Peeling of skin, severe headache, and hepatosplenomegaly
(B) Severe scurvy-like hemorrhages of the sublingual bleeding gums
(C) Excessive, systemic metastatic calcification of visceral soft tissues
(D) Severe sensory neuropathy, paresthesia, and acute cerebellar ataxia

123. Consider the following statements:
Statement I: Hypervitaminosis D leads to hypercalcemia, which can result in the pathological calcification of soft tissues like the kidneys and blood vessels.
Statement II: Hypervitaminosis D can easily occur from prolonged, excessive exposure to sunlight.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

124. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Toxicity from excessive intake of fat-soluble vitamins is far more common than toxicity from water-soluble vitamins.
Reason (R): Fat-soluble vitamins accumulate in the liver and adipose tissues, whereas excess water-soluble vitamins are generally excreted rapidly by the kidneys.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

Downloaded from www.pdf.tube

125. Identify the incorrect statement regarding the Tolerable Upper Intake Level (UL).
(A) The UL is intended as a recommended target intake for athletes and pregnant women.
(B) UL is the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals.
(C) As intake increases above the UL, the potential risk of adverse effects increases.
(D) Not all vitamins and minerals have an established UL due to a lack of toxicological data.

126. Arctic explorers who consume the livers of polar bears or seals are at extreme risk of developing acute, potentially fatal toxicity from which specific micronutrient?
(A) Vitamin C
(B) Vitamin D
(C) Vitamin A
(D) Iron

127. Match the nutrients in List I with their associated toxicity signs in List II.
List I: (Nutrients)
P. Fluoride
Q. Iron
R. Vitamin B6 (Pyridoxine)
S. Vitamin D
List II: (Associated Toxicity Signs)
I. Severe sensory neuropathy (nerve damage)
II. Mottled tooth enamel and skeletal abnormalities
III. Hypercalcemia and kidney stones
IV. Hepatic cirrhosis and skin pigmentation (bronze diabetes)
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-III, R-II, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-II, Q-IV, R-I, S-III

128. All of the following are clinical manifestations or consequences of Hemochromatosis (iron overload), EXCEPT:
(A) Liver cirrhosis
(B) Cardiomyopathy
(C) Macrocytic anemia
(D) Diabetes mellitus due to pancreatic damage

129. Identify the correct pair connecting a nutrient to the primary organ damaged during its severe toxicity.
(A) Vitamin K – Severe alveolar destruction and acute pulmonary fibrosis
(B) Vitamin A – Chronic hepatotoxicity and portal tract fibrosis
(C) Vitamin C – Neuronal oxidative damage and fatal encephalopathy
(D) Zinc – Accelerated coronary occlusion and acute myocardial infarction

130. Arrange the progressive clinical and physiological stages of Vitamin D toxicity (hypervitaminosis D):
I. Elevation of serum 25-hydroxyvitamin D levels above toxic thresholds.
II. Persistent hypercalcemia and hypercalciuria.
III. Calcification of soft tissues (nephrocalcinosis and vascular calcification).
IV. Irreversible renal failure.
Which of the following represents the correct progressive sequence of stages?
(A) I, II, III, IV
(B) I, III, II, IV
(C) III, II, I, IV
(D) I, II, III, IV

131. A patient self-prescribes megadoses of a specific vitamin for several months to treat premenstrual syndrome (PMS). The patient gradually develops an unsteady gait, numbness in the feet, and impaired reflex functions. These neurological symptoms strongly indicate toxicity of:
(A) Pyridoxine (B6)
(B) Thiamine (B1)
(C) Niacin (B3)
(D) Folic acid (B9)

NODIA

132. What is the strict medical definition of "Hypervitaminosis"?
(A) The beneficial synergistic clinical effect achieved when multiple vitamins are consumed simultaneously by patients.
(B) A rare congenital metabolic absorption disorder where the human body cannot absorb any water-soluble vitamin compounds.
(C) An abnormal condition resulting from the excessive and toxic accumulation of a vitamin in the body.
(D) The accelerated physical and chemical breakdown of dietary vitamins within standard tissues due to high bodily fever.

133. Which of the following accurately describes the cause-effect pathology of severe chronic iron toxicity?
(A) Excess unbound iron generates highly

reactive hydroxyl radicals via the Fenton reaction, leading to lipid peroxidation and severe organ damage.
(B) Excess circulatory iron directly binds to ionic calcium in plasma, causing severe systemic hypocalcemia and neuromuscular tetany.
(C) Excess free iron in the gastric lumen destroys mucosal parietal cells, completely inhibiting intrinsic factor secretion and causing anemia.
(D) High iron accumulation in thyroid tissues suppresses normal endocrine synthesis, leading directly to the onset of severe toxic goiter.

134. Identify the incorrect pair regarding general RDA principles for the Indian adult population.
(A) Calcium – The daily physiological requirement increases dramatically during the stages of pregnancy and active lactation
(B) Vitamin C – The daily dietary intake requirement is significantly increased in heavy smokers to combat cellular oxidative stress
(C) Folic Acid – Supplemental daily intake of synthetic folate is highly crucial for young women who are actively planning a pregnancy
(D) Iron – Requirement is generally higher for adult men than for adult women of reproductive age

135. What is the most scientifically sound advice regarding the consumption of dietary supplements to avoid toxicity?
(A) Natural herbal-based supplements can never cause systemic toxicity under any circumstances, whereas synthetic vitamins are highly hazardous.
(B) Supplements should generally not exceed the Tolerable Upper Intake Level (UL) unless prescribed for a diagnosed deficiency.
(C) Water-soluble vitamin supplements can be taken in completely unlimited daily quantities because they are cleared instantly by the kidneys.
(D) Highly concentrated fat-soluble vitamins should be consumed daily at ten times the standard RDA to rapidly build systemic immune defenses.

136. Consider the following statements regarding the context of mineral deficiencies in the Indian population:
I. Iron deficiency anemia is a major public health challenge, particularly among women and children.
II. Iodine deficiency disorders have been entirely eradicated in India due to salt iodization.
III. Zinc deficiency is recognized as a contributing factor to stunting in Indian children.
IV. Phytate-rich cereal-based Indian diets significantly reduce the bioavailability of iron and zinc.
Which of the above statements is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

137. Which instrumental analytical technique is considered the "gold standard" for the precise quantitative analysis of trace minerals (like lead, cadmium, zinc, and iron) in food matrices?
(A) Gas Chromatography (GC)
(B) High-Performance Liquid Chromatography (HPLC)
(C) Fourier-Transform Infrared Spectroscopy (FTIR)
(D) Atomic Absorption Spectroscopy (AAS)

138. In the standard titrimetric analysis of ascorbic acid (Vitamin C) in fruit juices, which of the following is the most commonly used redox dye (titrant)?
(A) 2,6-Dichlorophenolindophenol (DCPIP)
(B) Phenolphthalein pH indicator
(C) Methyl orange azo dye indicator
(D) Potassium dichromate salt reagent

139. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): High-Performance Liquid Chromatography (HPLC) is extensively used for the simultaneous determination of water-soluble and fat-soluble vitamins in fortified foods.
Reason (R): HPLC allows for the separation, identification, and quantification of complex vitamin mixtures with high sensitivity and specific detector systems (like UV or fluorescence).
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

Click Here to Buy book on Amazon

140. Consider the following statements:
Statement I: The "Anemia Mukt Bharat" strategy in India focuses exclusively on providing iron and folic acid supplements to pregnant women.
Statement II: The strategy adopts a "6x6x6" life cycle approach targeting six beneficiary groups, six interventions, and six institutional mechanisms.
Which of the above statements is/are correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

141. Which advanced analytical technique is most competent for simultaneous multi-elemental mineral profiling (e.g., measuring Na, K, Ca, Mg, Fe, and Zn in a single run) of a complex food sample?
(A) Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
(B) Single-channel low-temperature emission Flame Photometry
(C) UV-Visible Spectrophotometry using quartz microcuvettes
(D) Thin Layer Chromatography (TLC) with silica gel plates

142. Match the specific nutrients in List I with their typical or standardized method of food analysis in List II.
List I: (Nutrients)
P. Sodium and Potassium
Q. Vitamin C
R. Heavy metals and trace minerals
S. Vitamin A (Retinol)
List II: (Methods of Food Analysis)
I. HPLC with UV or Fluorescence detector
II. Flame Photometry
III. 2,6-DCPIP Titration
IV. Atomic Absorption Spectroscopy (AAS)
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-I, R-II, S-III
(C) P-II, Q-III, R-IV, S-I
(D) P-III, Q-IV, R-I, S-II

143. Identify the incorrect pair regarding analytical instruments and their underlying principles.
(A) Flame Photometer – Measures the intensity of light emitted by excited atoms.
(B) Atomic Absorption Spectroscopy – Measures the absorption of light by free ground-state atoms in a gaseous state.
(C) UV-Vis Spectrophotometer – Measures the absorption of ultraviolet or visible light by a substance in solution.
(D) HPLC – Separates compounds based strictly on their boiling points.

144. All of the following are considered highly prevalent, major public health mineral deficiency issues in India, EXCEPT:
(A) Iron
(B) Iodine
(C) Selenium
(D) Zinc

145. When preparing a solid food sample (like wheat flour) for trace mineral analysis via Atomic Absorption Spectroscopy (AAS), what critical pre-treatment step must strictly be performed to ensure accurate measurement?
(A) The organic sample must be completely dissolved in a non-polar organic solvent such as hexane or diethyl ether prior to nebulization.
(B) The sample must undergo complete wet or dry ashing (digestion) to destroy all organic matter and release the free minerals.
(C) The composite food sample must be deeply cryogenic frozen and directly analyzed in its solid crystalline phase without melting.
(D) The sample must be heated mildly to exactly 60°C in an aqueous bath to fully activate endogenous metal-binding enzyme systems.

146. Which statement is correct regarding the prevalence of fluorosis in the Indian context?
(A) Fluorosis is entirely and completely absent across the territory of India due to the universal implementation of household-level membrane filtration systems.
(B) Fluorosis in India is exclusively and solely caused by the unintended, massive over-consumption of commercially available artificially fluoridated dentifrices.
(C) Only advanced skeletal fluorosis is clinically diagnosed within India, whereas superficial cosmetic dental fluorosis does not manifest in any demographic.
(D) Endemic fluorosis is heavily concentrated in

NODIA

states with high natural geological fluoride levels in groundwater, such as Rajasthan, Gujarat, and Andhra Pradesh.

147. What is the fundamental principle of Atomic Absorption Spectroscopy (AAS)?
(A) Measurement of the absorption of specific wavelengths of light by free, unexcited ground-state atoms.
(B) Quantitative measurement of electromagnetic radiation emitted when thermally excited atoms return to the low-energy ground state.
(C) Electrostatic separation of gaseous ions strictly based on their specific mass-to-charge ratio inside an oscillating magnetic field.
(D) Qualitative identification of functional organic groups based on their molecular stretching and infrared light absorption patterns.

148. Which cause-effect relationship correctly explains the historical geographical distribution of goiter in India?
(A) High soil salinity in coastal areas blocked root uptake of iodine in crops, leading to massive thyroid swelling misdiagnosed as hyperthyroidism.
(B) Ancient volcanic eruptions in central India deposited toxic levels of active sulfur, creating heavy concentrations of goitrogens in agricultural soils.
(C) Heavy rainfall and glaciation in the Himalayan and sub-Himalayan regions leached iodine from the soil, leading to iodine-deficient crops and endemic goiter.
(D) Excessive consumption of fresh sea fish in southern coastal states led to chronic iodine toxicity, which clinical doctors misdiagnosed as endemic goiter.

149. Identify the correct pair associating a vitamin with an analytical method traditionally used for its quantification based on the growth of specific bacterial strains.
(A) Vitamin B12 – Microbiological assay using Lactobacillus leichmannii
(B) Vitamin C – Analytical gravimetric precipitation using barium chloride
(C) Vitamin A – Polarimetry of optical rotation in organic solvents
(D) Vitamin D – Standardized Karl Fischer dead-stop electrometric titration

150. A sample of retail pasteurized milk declaring "+F" fortification is found to have no detectable Vitamin A content upon laboratory analysis. Assuming the manufacturer initially added the correct amount of retinyl palmitate, what is the most scientifically plausible explanation for its total loss?
(A) The milk underwent high-pressure mechanical homogenization, which physically shears and destroys all fat-soluble vitamin structures.
(B) The milk was simultaneously fortified with high concentrations of ionic calcium, which completely neutralizes and precipitates Vitamin A.
(C) The milk was rapidly chilled to under 4°C immediately after thermal pasteurization, initiating accelerated cold-precipitation of vitamins.
(D) The milk was stored in clear, transparent pouches exposed directly to intense sunlight for hours.

NODIA

www.nodia.in

ANSWERS

1. (B) I, II, and IV
Vitamins are classified by their solubility in water or lipids. Fat-soluble vitamins require bile salts for proper micelle formation and subsequent absorption in the intestine. Water-soluble vitamins are not heavily stored in the body, with excess excreted in urine, but vitamin C and the B-complex group are indeed classified as water-soluble.

2. (D) Halibut liver oil
Preformed vitamin A, known as retinol, is found exclusively in animal-derived foods. Marine fish liver oils, particularly halibut and cod liver oils, are the most concentrated natural dietary sources of this nutrient. Plant sources like carrots, spinach, and sweet potatoes contain provitamin A carotenoids, which must be converted into active retinol within the body.

3. (A) Both Statement I and Statement II are correct.
Visual phototransduction relies on the conversion of light into electrical signals in the retina. The primary active form of vitamin A involved in this visual cycle is 11-cis-retinal. This compound binds directly to the apoprotein opsin within the rod cells, forming the light-sensitive photopigment rhodopsin, which is essential for vision under low-light conditions.

4. (A) Both A and R are true and R is the correct explanation of A.
Night blindness serves as the earliest clinical symptom of vitamin A deficiency due to compromised rod cell function. Rhodopsin is the photopigment responsible for detecting dim light. When systemic stores of vitamin A are depleted, the regeneration of 11-cis-retinal is impaired, preventing the adequate resynthesis of rhodopsin and disabling low-light adaptation.

5. (A) It acts as a primary coenzyme in oxidative decarboxylation reactions during energy metabolism.
Vitamin A does not function as a coenzyme in oxidative decarboxylation reactions, which is a role characteristic of thiamine pyrophosphate. Instead, vitamin A is critical for cellular differentiation, epithelial tissue maintenance, and reproductive health. In the form of retinoic acid, it acts as a hormone that regulates nuclear gene expression through specific receptors.

6. (D) Administration of a massive dose of oral retinol
The presentation of foamy, silvery-grey plaques on the bulbar conjunctiva describes Bitot's spots, a classic sign of advanced vitamin A deficiency. The standard therapeutic intervention for this ocular manifestation is the immediate administration of high-dose oral retinol. This treatment rapidly restores systemic vitamin stores and prevents progression to corneal ulceration and permanent blindness.

7. (B) P-III, Q-IV, R-I, S-II
Retinol serves as the major transport form of vitamin A in the blood and is stored as retinyl esters. Retinal is the active component of visual pigments in the retina. Retinoic acid regulates gene transcription and cell differentiation. Beta-carotene functions as a lipid-soluble antioxidant and serves as a provitamin precursor for retinol synthesis.

8. (C) They are readily excreted in the urine when intake exceeds requirement.
Fat-soluble vitamins are hydrophobic molecules absorbed into the lymphatic system via chylomicrons and transported in the blood bound to carrier proteins. Because they are stored in hepatic and adipose tissues rather than being readily excreted in urine, excessive intake poses a high risk of accumulation and potential systemic toxicity compared to water-soluble vitamins.

9. (D) Keratomalacia – Softening and necrosis of the cornea
Keratomalacia is the severe, late-stage manifestation of vitamin A deficiency characterized by progressive softening, liquefactive necrosis, and perforation of the cornea. Bitot's spots represent localized keratinization on the conjunctiva, xerosis involves abnormal dryness of the ocular membranes, and nyctalopia is night blindness, which is the inability to see in low-light conditions.

Downloaded from www.pdf.tube

10. (A) II, IV, I, III
Xerophthalmia progress begins with night blindness due to impaired rhodopsin regeneration. This is followed by conjunctival xerosis, characterized by dry, keratinized conjunctiva. Continued deficiency leads to corneal xerosis, where the cornea loses its luster and becomes hazy. Finally, keratomalacia develops, representing liquefactive necrosis of the cornea, which can lead to permanent blindness.

11. (B) Irreversible permanent blindness
Severe vitamin A deficiency in pediatric patients, particularly when exacerbated by protein-energy malnutrition, leads rapidly to advanced corneal xerophthalmia. If untreated, corneal ulceration progresses to keratomalacia, which causes structural collapse of the eyeball and irreversible permanent blindness. Prompt treatment with oral or intramuscular vitamin A is critical to save the child's sight.

12. (B) An inactive precursor compound that must be converted into the active vitamin within the body
A provitamin is a naturally occurring, biologically inactive precursor compound that requires enzymatic or metabolic conversion within the human body to become an active vitamin. Beta-carotene is a classic example of a provitamin, as it is cleaved in the intestinal mucosa and liver to yield active retinal and retinol molecules.

13. (A) Malabsorption and subsequent deficiency of vitamins A, D, E, and K
Biliary obstruction impedes the flow of bile into the small intestine, preventing the emulsification of dietary lipids. Since fat-soluble vitamins depend on mixed micelle formation for absorption, this disruption leads directly to lipid malabsorption. Consequently, the body cannot absorb vitamins A, D, E, and K, leading to progressive systemic deficiencies of these essential nutrients.

14. (C) Carotenemia – Jaundice-like yellowing of the sclera (eyes)
Carotenemia is a benign condition caused by excessive dietary intake of carotenoids, resulting in a yellow-orange discoloration of the skin, particularly on the palms and soles. Unlike pathological jaundice, carotenemia does not cause yellowing of the sclera because bilirubin levels remain normal. Hypervitaminosis A carries severe risks, including teratogenicity and increased intracranial pressure.

15. (D) Serum retinol concentration falling below 20 μg/dL
Assessing subclinical vitamin A status is vital before overt ocular symptoms develop. A serum retinol concentration falling below twenty micrograms per deciliter is the most widely established biochemical marker indicating depleted hepatic vitamin A reserves. This threshold reflects inadequate circulating retinol-binding protein complexes, signaling a critical need for dietary or supplemental intervention.

16. (C) I, II, and III
Vitamin D synthesis begins when solar UV-B radiation photolyzes dermal 7-dehydrocholesterol into pre-vitamin D3, which isomerizes to cholecalciferol. The first hydroxylation occurs in the liver, yielding 25-hydroxyvitamin D. The second hydroxylation takes place in the kidneys, forming active calcitriol. This renal step is stimulated by parathyroid hormone, not calcitonin.

17. (B) Acting as a chain-breaking lipid-soluble antioxidant in cell membranes
Vitamin E consists of tocopherols and tocotrienols, which function primarily as potent, chain-breaking, lipid-soluble antioxidants within cell membranes. By donating hydrogen atoms to free radicals, vitamin E prevents the propagation of lipid peroxidation in polyunsaturated fatty acids. This protective mechanism maintains membrane integrity and shields cells from oxidative stress damage.

18. (D) Factors II, VII, IX, and X
Vitamin K acts as an essential cofactor for gamma-glutamyl carboxylase, the enzyme responsible for the post-translational modification of specific glutamic acid residues. This carboxylation process allows these proteins to bind calcium ions, which is vital for membrane association. This modification is required to activate clotting factors II, VII, IX, and X.

19. (A) Both A and R are true and R is the correct explanation of A.
Individuals residing in high-latitude regions face a high risk of vitamin D deficiency during winter. The low zenith angle of the sun causes solar ultraviolet radiation to pass through a thicker atmospheric layer, scattering UV-B rays. Consequently, the skin cannot synthesize cholecalciferol, making

NODIA

these populations dependent on dietary intake or supplements.

20. (A) Both Statement I and Statement II are correct.
Vitamin E structures differ based on the saturation of their side chains. Tocopherols contain a fully saturated phytyl tail, whereas tocotrienols have an unsaturated isoprenoid side chain containing three double bonds. Among these compounds, alpha-tocopherol exhibits the highest affinity for the hepatic transfer protein, rendering it the most biologically active form.

21. (A) Maintain a consistent daily intake of Vitamin K-rich foods to prevent fluctuations in drug efficacy.
Warfarin acts as a vitamin K antagonist, inhibiting the regeneration of active vitamin K. Sudden changes in dietary vitamin K intake from greens like spinach and kale can alter the therapeutic efficacy of warfarin. Maintaining a consistent daily intake allows clinicians to calibrate drug dosing accurately, minimizing the risk of thrombosis or bleeding.

22. (D) P-III, Q-I, R-IV, S-II
Vitamin D deficiency in growing children impairs bone mineralization, causing rickets, while in adults it leads to osteomalacia. Vitamin E deficiency increases oxidative fragility in erythrocyte membranes, leading to premature hemolysis. Deficiency of vitamin K compromises the carboxylation of clotting factors, manifesting clinically as hemorrhagic disease due to prolonged prothrombin time.

23. (B) Vitamin K1 – Menaquinone
The chemical nomenclature of vitamins distinguishes between their natural forms. Vitamin K1, which is synthesized by plants, is chemically known as phylloquinone. Menaquinone is the designation for vitamin K2, which is synthesized by intestinal bacteria. Vitamin D2 is ergocalciferol, vitamin D3 is cholecalciferol, and active vitamin E is alpha-tocopherol.

24. (C) Decreasing the intestinal absorption of dietary phosphorus
Calcitriol, the active form of vitamin D, functions to elevate serum calcium and phosphate levels. It acts on the enterocytes to increase the expression of calcium-binding proteins and sodium-dependent phosphate cotransporters, thereby enhancing the absorption of both minerals. It also promotes renal calcium reabsorption and works with parathyroid hormone to mobilize skeletal calcium.

25. (D) Vitamin E
Premature infants are born with low tissue stores of vitamin E due to poor placental transfer during late gestation. When these infants are placed in high-oxygen environments, their red blood cell membranes are exposed to high oxidative stress. Lacking sufficient vitamin E antioxidant protection, the erythrocyte lipids undergo rapid peroxidation, resulting in hemolytic anemia.

26. (A) Rickets involves defective mineralization of growing bone cartilage, whereas osteomalacia involves demineralization of adult bone.
Rickets and osteomalacia are both mineralization disorders caused by vitamin D deficiency, but they differ by skeletal maturity. Rickets occurs in children prior to epiphyseal fusion, impairing cartilage mineralization in growing bones. Osteomalacia occurs in adults after epiphyseal closure, characterized by deficient mineralization of newly formed osteoid during bone remodeling.

27. (B) The naturally occurring animal form of Vitamin D synthesized in the skin (Vitamin D3)
Cholecalciferol is the chemical name for vitamin D3, the animal form of this secosteroid. It is synthesized indigenously in the skin of humans and animals when ultraviolet-B light photolyzes 7-dehydrocholesterol. This compound is biologically inactive and must undergo successive hydroxylations in the liver and kidneys to become hormonally active calcitriol.

28. (B) Impaired bile production leads to defective micelle formation and fat-soluble vitamin malabsorption.
Patients with severe liver cirrhosis suffer from compromised bile acid synthesis and secretion. The lack of sufficient bile salts in the duodenum prevents the emulsification of dietary fats and the formation of mixed micelles. Consequently, the absorption of fat-soluble vitamin K is impaired, leading to a secondary deficiency that compromises coagulation factor activation.

29. (A) Vitamin B2 – Flavin adenine dinucleotide
The B-complex vitamins serve as essential precursors to highly specialized metabolic coenzymes. Vitamin B2, known chemically as riboflavin, is converted into flavin adenine

Click Here to Buy book on Amazon

dinucleotide and flavin mononucleotide. Conversely, thiamine forms thiamine pyrophosphate, niacin forms nicotinamide adenine dinucleotide, and pyridoxine is converted into the active coenzyme pyridoxal phosphate.

30. (C) Osteomalacia resulting from chronic systemic Vitamin D deficiency
Unregulated sun exposure limits are common among homebound elderly individuals, who face a high risk of vitamin D deficiency. This deficiency impairs calcium absorption, leading to compensatory hyperparathyroidism. Over time, the poor mineralization of newly remodeled adult bone osteoid manifests as osteomalacia, presenting clinically with deep bone pain, proximal muscle weakness, and a characteristic waddling gait.

31. (D) I, II, and III
Thiamine, riboflavin, and niacin are critical for cellular respiration. Thiamine pyrophosphate acts in the pyruvate dehydrogenase complex. Riboflavin-derived FAD and FMN undergo redox cycles in the respiratory chain, while niacin-derived NAD+ and NADP+ transfer hydride ions. Pyridoxine acts as a coenzyme in amino acid metabolism, not exclusively in carbohydrate pathways.

32. (C) Animal-derived foods
Cobalamin, known as vitamin B12, is synthesized exclusively by certain anaerobic microorganisms. Because plants neither require nor produce this vitamin, animal-derived foods like meat, fish, poultry, eggs, and dairy products are the only natural dietary sources for humans. Consequently, strict vegans must obtain this nutrient through fortified foods or supplements.

33. (C) Statement I is correct but Statement II is incorrect.
L-ascorbic acid, or vitamin C, functions as a powerful reducing agent and antioxidant by donating electrons to neutralize reactive oxygen species. Although its chemical structure resembles that of glucose, humans cannot synthesize vitamin C from glucose because they lack L-gulonolactone oxidase, the final enzyme in the synthetic pathway.

34. (A) Both A and R are true and R is the correct explanation of A.
Mandatory fortification of cereal grain products with folic acid is a highly effective public health measure. Folate is crucial for nucleic acid synthesis and cell division during embryonic development. Adequate folic acid intake during the periconceptional period ensures proper neural tube closure, significantly reducing the risk of birth defects like spina bifida.

35. (A) It functions as the specific carrier of methyl groups in homocysteine metabolism.
Riboflavin does not function as a carrier of methyl groups in homocysteine metabolism, which is a role reserved for vitamin B12 and folate. Riboflavin imparts a yellow-green fluorescent color to whey and is highly sensitive to UV light. Its deficiency presents with symptoms such as cheilosis, angular stomatitis, and glossitis.

36. (C) Niacin
Pellagra is a nutritional deficiency disease characterized by dermatitis, diarrhea, and dementia. This condition occurs in populations reliant on corn as their staple food. The niacin in maize is chemically bound as niacytin, making it biologically unavailable unless the corn is treated with an alkaline solution, which hydrolyzes the ester bonds and releases free niacin.

37. (A) P-III, Q-IV, R-I, S-II
The active coenzyme forms of these vitamins participate in distinct pathways. Pantothenic acid is a critical constituent of coenzyme A, which is essential for acyl group transfer. Biotin binds to lysine residues to form biocytin. Pyridoxine is converted into pyridoxal phosphate for transamination, while folic acid is metabolized into tetrahydrofolate for single-carbon transfer reactions.

38. (D) High doses of Vitamin C are stored extensively in adipose tissue for long-term use.
Water-soluble vitamins are generally not stored in the body and are excreted in the urine, requiring consistent dietary intake. While vitamin B12 is a notable exception due to substantial hepatic storage, vitamin C is not stored in adipose tissue. Excess ascorbic acid is cleared by the kidneys, and tissue saturation levels cannot be exceeded.

39. (B) Vitamin B12 – Classic pernicious anemia
Pernicious anemia is an autoimmune disorder where the gastric mucosa fails to secrete intrinsic factor, preventing the absorption of vitamin B12. This deficiency impairs DNA synthesis in red blood cell precursors, leading to megaloblastic changes. In contrast, thiamine deficiency causes

NODIA

beriberi, niacin deficiency leads to pellagra, and riboflavin deficiency causes angular cheilosis.

40. (C) II, I, IV, III
Scurvy progresses through distinct physiological stages. It begins with a subclinical decrease in tissue saturation of ascorbic acid. This is followed by early clinical symptoms like petechiae and bleeding gums. As collagen synthesis fails further, impaired wound healing and joint pain develop. Without intervention, severe cases culminate in sudden death from cardiac failure.

41. (D) Vitamin B12 deficiency
A strict vegan diet devoid of animal products leads to vitamin B12 deficiency, as plants do not synthesize this nutrient. This deficiency impairs the conversion of methylmalonyl-CoA to succinyl-CoA, causing myelin sheath degeneration and neurological symptoms like paresthesia. It also arrests DNA synthesis, leading to macrocytic anemia and characteristic tongue inflammation.

42. (A) It functions as a reducing agent to maintain iron in the ferrous (Fe^{2+}) state for prolyl and lysyl hydroxylases.
Collagen synthesis requires the post-translational hydroxylation of proline and lysine residues to stabilize the triple helix structure. The enzymes prolyl hydroxylase and lysyl hydroxylase require iron in its active ferrous state. Ascorbic acid acts as a specific electron donor, reducing inactive ferric iron back to the active ferrous form, thereby sustaining enzymatic activity.

43. (B) Alcohol interferes with thiamine absorption and utilization, causing severe neuronal energy deficit.
Chronic alcohol consumption causes Wernicke-Korsakoff syndrome by severely impairing intestinal thiamine absorption and reducing its active phosphorylation into thiamine pyrophosphate. Since thiamine pyrophosphate is a crucial coenzyme for cerebral carbohydrate metabolism and energy production, this deficiency leads to ATP depletion, cellular dysfunction, and localized neurodegenerative changes in the brain.

44. (B) Vitamin B5 – Pyridoxine
The B-complex vitamins are historically classified by numerical designations. Vitamin B1 is thiamine, vitamin B2 is riboflavin, and vitamin B7 is biotin. Vitamin B5 is pantothenic acid, not pyridoxine. Pyridoxine is designated as vitamin B6. Misidentifying these distinct numerical designations is a common error in clinical and biochemistry examinations.

45. (A) Steaming or microwaving whole or large pieces with minimal water
Vitamin C is highly water-soluble, heat-labile, and easily oxidized. To maximize its retention in vegetables, cooking methods should minimize water contact and heating duration. Steaming or microwaving whole or large pieces of food reduces the leaching of ascorbic acid into the cooking liquid and limits thermal degradation, resulting in superior nutrient preservation.

46. (C) I, III, and IV
Vitamin stability varies significantly under processing conditions. Ascorbic acid is highly sensitive to heat, light, and alkaline environments. Thiamine is rapidly destroyed by sulfites, which cleave its methylene bridge. Niacin is exceptionally robust and resists standard cooking temperatures. Fat-soluble vitamins, being hydrophobic, do not readily leach into aqueous cooking water.

47. (D) Ascorbic acid
Ascorbic acid, or vitamin C, is widely recognized as the most heat-labile and unstable micronutrient during food processing. Its chemical structure is easily oxidized to dehydroascorbic acid, particularly in the presence of heat, light, oxygen, and alkaline conditions. Consequently, prolonged thermal processing leads to significant losses of this essential water-soluble vitamin.

48. (C) 100 mg per day
Minerals required by the human body are classified into macrominerals and microminerals. Microminerals, also referred to as trace elements, are essential inorganic nutrients required in small amounts, typically less than one hundred milligrams per day. Examples of trace elements include iron, zinc, copper, selenium, iodine, and manganese, which perform precise metabolic functions.

49. (A) Both A and R are true and R is the correct explanation of A.
Riboflavin, also known as vitamin B2, is highly sensitive to photolytic degradation. Exposure to light, particularly visible wavelengths, causes rapid photolysis of riboflavin into lumiflavin. Packaging fluid milk in opaque plastic or cardboard containers protects this light-sensitive

Downloaded from www.pdf.tube

nutrient from light-induced destruction, whereas transparent glass bottles fail to prevent this degradation.

50. (C) Statement I is correct but Statement II is incorrect.
Blanching is a short heat treatment that denatures enzymes like ascorbic acid oxidase, preventing the enzymatic degradation of vitamin C during subsequent frozen storage. However, because blanching involves hot water, it inevitably causes some loss of water-soluble vitamins through thermal destruction and direct leaching into the surrounding water.

51. (A) A UV and visible light-blocking amber or opaque sleeve
Riboflavin and vitamin A are highly sensitive to light-induced degradation. Exposure to ultraviolet and visible light initiates photolytic reactions that degrade riboflavin and isomerize vitamin A, destroying their nutritional value. Utilizing an amber or opaque sleeve on the packaging blocks these destructive wavelengths, ensuring the stability and retention of these fortified nutrients.

52. (C) P-III, Q-IV, R-I, S-II
Vitamins exhibit different susceptibilities to chemical and environmental factors. Vitamin C is easily oxidized in alkaline environments. Thiamine is cleaved by sulfites under neutral heat. Riboflavin is highly sensitive to visible and ultraviolet light. Vitamin E is a lipid-soluble antioxidant that undergoes degradation in the presence of lipid oxidation and rancidity.

53. (A) Magnesium – Micromineral
Essential minerals are classified based on the body's daily requirements. Macrominerals are required in quantities exceeding one hundred milligrams per day, which includes calcium, phosphorus, and magnesium. Classifying magnesium as a micromineral is incorrect because it is a major mineral essential for bone structure, enzyme activation, and muscle contraction.

54. (D) Zinc
Macrominerals are major minerals required by the body in large amounts, such as sodium, potassium, calcium, phosphorus, magnesium, and sulfur. Zinc is classified as a micromineral or trace element because the daily physiological requirement is extremely small, typically less than fifteen milligrams per day, despite its extensive structural and enzymatic roles.

55. (B) Maillard reaction
High-temperature short-time extrusion cooking promotes the Maillard reaction, a non-enzymatic browning process between reducing sugars and the free amino group of essential lysine. This reaction reduces the bioavailability of lysine and generates reactive intermediates that can degrade heat-sensitive B-vitamins like thiamine, leading to significant nutritional losses in processed cereals.

56. (C) The extraction and loss of water-soluble nutrients into the cooking liquid.
Leaching is a physical phenomenon where water-soluble nutrients migrate from a food matrix into the surrounding cooking liquid. This process is driven by concentration gradients and is a primary cause of nutrient loss during boiling, blanching, or canning. Soluble vitamins, such as vitamin C and the B-complex group, are highly susceptible to leaching.

57. (D) An inorganic element essential to human health that represents less than 0.01% of total body weight.
A micromineral, or trace element, is an inorganic element essential to human health that is required in minute amounts. By scientific definition, these minerals represent less than 0.01% of the total human body weight. Examples include iron, zinc, copper, selenium, and manganese, which act as crucial enzyme cofactors and structural components.

58. (A) Treatment of dried fruits with sulfur dioxide specifically cleaves and destroys the thiamine molecule.
Sulfur dioxide is commonly used as a preservative in dried fruits to prevent browning and microbial spoilage. However, sulfites chemically attack the methylene bridge of thiamine, splitting the molecule into its constituent thiazole and pyrimidine rings. This reaction destroys the thiamine molecule, rendering it biologically inactive and causing significant nutrient loss.

59. (B) UHT processing of milk – Superior retention of water-soluble vitamins compared to prolonged boiling
Ultra-High Temperature processing of milk utilizes extremely high heat for a very brief duration, typically one to two seconds. This rapid

NODIA

thermal process is highly effective at commercial sterilization while minimizing the heat exposure of the milk. Consequently, UHT processing results in a superior retention of heat-sensitive water-soluble vitamins compared to prolonged boiling.

60. (B) Vitamin C
Vitamin C, or ascorbic acid, is highly heat-sensitive and easily oxidized. While vitamins A and D are fat-soluble and relatively stable under thermal treatments, and calcium is an indestructible inorganic element, vitamin C undergoes significant degradation during ultra-high temperature processing. Consequently, UHT milk exhibits the most substantial percentage loss of vitamin C.

61. (A) I, II, and III
Calcium is an essential mineral serving multiple biological roles. It forms hydroxyapatite crystals in the extracellular matrix of bones and teeth, providing structural rigidity. It also acts as an intracellular second messenger in cell signaling, regulates neurotransmitter release at synapses, and activates muscle contraction. Iron, not calcium, binds oxygen in myoglobin.

62. (C) Red meat (beef)
Dietary iron exists in two forms: heme and non-heme iron. Heme iron, found exclusively in animal tissues such as red meat, beef, and fish, is highly bioavailable because it is absorbed intact via specific mucosal transporters. Non-heme iron, found in plants and fortified cereals, is much less soluble and highly sensitive to absorption inhibitors.

63. (A) Both Statement I and Statement II are correct.
Vitamin C significantly enhances the absorption of non-heme iron. It acts as a reducing agent in the acidic environment of the stomach, converting insoluble ferric iron to the soluble ferrous state. Ferrous iron remains stable and soluble at the alkaline pH of the duodenum, allowing efficient uptake by enterocyte metal transporters.

64. (A) Both A and R are true and R is the correct explanation of A.
Diets high in unrefined cereals and legumes can induce calcium and iron deficiencies due to high phytic acid content. Phytic acid, or phytate, is a storage form of phosphorus that acts as a strong chelator. It binds divalent cations like calcium, iron, and zinc, forming insoluble, indigestible complexes that resist human intestinal absorption.

65. (B) It plays a primary role in the initiation of the blood coagulation cascade.
Phosphorus is a highly vital mineral that forms the structural backbone of nucleic acids, constitutes high-energy phosphate bonds in adenosine triphosphate, and serves as a major intracellular buffer. Calcium, not phosphorus, is the specific mineral required for the enzymatic activation of several coagulation factors in the blood clotting cascade.

66. (D) Non-heme iron
Black tea contains high levels of polyphenols, specifically tannins, which are potent inhibitors of iron absorption. These compounds chelate non-heme iron in the intestinal lumen, forming insoluble complexes that cannot be absorbed. Over time, this leads to iron deficiency anemia, presenting with pallor, fatigue, and spoon-shaped nails known as koilonychia.

67. (A) P-II, Q-IV, R-III, S-I
Calcium deficiency causes neuromuscular irritability, presenting as tetany. Iron deficiency leads to microcytic hypochromic anemia due to impaired hemoglobin synthesis, whereas iron toxicity causes tissue deposition known as hemochromatosis. Phosphorus deficiency, often seen in genetic disorders of renal handling, can manifest as hypophosphatemic rickets due to inadequate skeletal mineralization.

68. (C) Meat, Fish, and Poultry (MFP) factor in animal tissues
Non-heme iron absorption is inhibited by several dietary components, including tannins in tea, oxalic acid in spinach, and phytic acid in whole grains, which form insoluble complexes in the gut. Conversely, the meat, fish, and poultry factor present in animal tissues enhances the absorption of non-heme iron by stimulating mucosal uptake.

69. (A) Hepcidin – Central regulatory hormone that inhibits iron efflux into the blood
Hepcidin is a peptide hormone synthesized by the liver that acts as the principal regulator of systemic iron homeostasis. It binds to the cellular iron exporter ferroportin, inducing its internalization and degradation. This action blocks iron efflux from enterocytes and macrophages into the

Click Here to Buy book on Amazon

bloodstream, thereby lowering plasma iron concentrations.

70. (D) II, III, I, IV
Iron deficiency develops in a progressive sequence. It begins with the depletion of stored iron, reflected by decreased serum ferritin. Next, iron-deficient erythropoiesis occurs, characterized by a drop in transferrin saturation. Continued depletion leads to frank anemia with reduced hemoglobin, culminating in morphological changes including microcytosis and hypochromia.

71. (B) Iron
Pica, the compulsive craving and consumption of non-nutritive substances like clay, chalk, or ice, is a well-documented clinical sign of iron deficiency. Although the underlying neurological mechanism remains not fully understood, this behavior is strongly associated with depletion of iron-dependent enzymes in the brain and frequently occurs alongside severe lethargy.

72. (C) The glycoprotein synthesized in the liver that binds and transports ferric iron (Fe^{3+}) in the blood.
Transferrin is a specialized plasma glycoprotein synthesized by the liver that plays a central role in systemic iron transport. It binds up to two ferric iron ions with high affinity, maintaining them in a soluble, non-toxic state within the circulation and delivering them to cells via receptor-mediated endocytosis.

73. (D) It leads to transient hypocalcemia, triggering PTH release and subsequent bone demineralization.
An excessively high dietary phosphorus-to-calcium ratio leads to transient hypocalcemia as phosphate binds free calcium in the intestinal lumen and circulation. This reduction in ionized calcium triggers the release of parathyroid hormone. Elevated PTH levels stimulate osteoclast activity, promoting bone resorption to restore blood calcium levels, thereby causing skeletal demineralization.

74. (A) Iron – Calcitonin
Regulatory hormones coordinate mineral homeostasis. Calcium is regulated by parathyroid hormone and calcitonin, sodium by aldosterone, and potassium is shifted intracellularly by insulin. Iron homeostasis is regulated primarily by the hepatic hormone hepcidin, which controls ferroportin activity. Calcitonin plays no direct role in the physiological regulation of systemic iron levels.

75. (B) Ferrous sulfate with L-ascorbic acid
Fortifying high-phytate cereals requires overcoming the inhibitory effects of phytates. Ferrous sulfate provides a highly soluble source of iron. Adding L-ascorbic acid acts to reduce ferric iron back to the soluble ferrous state, preventing its chelation by phytates. This synergistic combination significantly enhances the intestinal absorption and overall bioavailability of the iron.

76. (B) I, II, and III
Zinc is an essential trace element with diverse biological functions. It stabilizes the finger-like loops in DNA-binding proteins, enabling gene transcription. It acts as a cofactor for over three hundred metalloenzymes, and is critical for immune responses and wound healing. Iron, not zinc, is the central atom in heme.

77. (A) Cretinism (congenital hypothyroidism)
Iodine is the key structural component of thyroid hormones, which are essential for fetal brain development and myelination. Severe maternal iodine deficiency during early pregnancy impairs fetal thyroid hormone synthesis. This lack of hormone causes irreversible congenital hypothyroidism, clinically termed cretinism, characterized by severe cognitive deficits, deaf-mutism, and stunted growth.

78. (C) Ceruloplasmin
Ceruloplasmin is a major copper-carrying protein in the plasma that plays a crucial role in iron metabolism. It functions as a ferroxidase, catalyzing the oxidation of toxic ferrous iron to ferric iron. This oxidation is required for iron to bind to transferrin and be mobilized from storage sites to the marrow.

79. (A) Both A and R are true and R is the correct explanation of A.
Consuming diets rich in raw cassava and cabbage increases the prevalence of endemic goiter due to their goitrogen content. Cyanogenic glycosides in cassava release thiocyanate upon ingestion, which competitively inhibits the sodium-iodide symporter in the thyroid. This block in iodine uptake prevents hormone synthesis, triggering compensatory glandular enlargement.

Downloaded from www.pdf.tube

80. (C) Statement I is correct but Statement II is incorrect.
Manganese is an essential trace mineral that acts as a cofactor for several key enzymes, including mitochondrial superoxide dismutase, which actively neutralizes free radicals. It is classified as a micromineral, not a macromineral, meaning the human body requires it in very small daily amounts, typically under ten milligrams.

81. (B) Median urinary iodine concentration (UIC)
Over ninety percent of dietary iodine is excreted in the urine, making urinary excretion a direct reflection of recent intake. Measuring the median urinary iodine concentration in a representative school-aged population is the most practical, sensitive, and internationally recognized biochemical indicator for assessing and monitoring the iodine status of a community.

82. (D) P-II, Q-I, R-III, S-IV
Trace minerals serve as critical components of specialized proteins. Zinc is a cofactor for carbonic anhydrase, which catalyzes carbon dioxide hydration. Copper forms the catalytic core of cytochrome c oxidase in the respiratory chain. Manganese is required by mitochondrial pyruvate carboxylase, and iodine is covalently bound within thyroid-hormone-precursor thyroglobulin.

83. (A) Copper – Wilson's disease
Wilson's disease is an autosomal recessive genetic disorder characterized by impaired biliary copper excretion, leading to toxic copper accumulation in tissues like the liver and brain. It represents a copper overload or toxicity state, rather than a deficiency. Zinc deficiency causes growth retardation, while iodine deficiency leads to goiter.

84. (C) Refined polished rice
Animal products like oysters, shellfish, beef, and poultry are excellent dietary sources of zinc because they contain amino acids that enhance its solubility and absorption. Refined polished rice is a poor source because the zinc-rich outer germ and bran layers are removed during milling, leaving a highly low-zinc endosperm.

85. (A) Menkes disease
Menkes disease is an X-linked recessive genetic disorder caused by mutations in the ATP7A gene, which encodes a copper-transporting ATPase. This defect impairs copper absorption from the intestine and its distribution to tissues, causing systemic copper deficiency. This manifests as kinky hair, failure to thrive, and severe neurological degeneration.

86. (D) Phytates act as chelating agents that tightly bind zinc in the intestinal lumen, significantly decreasing its absorption.
Phytates are negatively charged myo-inositol hexakisphosphate compounds abundant in whole grains and legumes. In the gastrointestinal tract, they act as strong chelating agents that bind zinc ions, forming insoluble, indigestible complexes that resist enzymatic cleavage. This interaction prevents zinc uptake by mucosal enterocytes, significantly decreasing its absorption and bioavailability.

87. (B) A syndrome of severe physical and mental retardation resulting from maternal iodine deficiency during fetal development.
Cretinism is a pathological syndrome characterized by severe physical and mental developmental delay. This condition arises from maternal iodine deficiency, which causes fetal hypothyroidism during critical windows of brain development. It manifests in two clinical forms, neurological and myxedematous, presenting with cognitive deficits, short stature, deaf-mutism, and neuromotor spasticity.

88. (C) A genetic mutation impairs the intestinal ZIP4 transporter, causing severe systemic zinc deficiency.
Acrodermatitis enteropathica is a rare autosomal recessive disorder caused by mutations in the SLC39A4 gene, which encodes the intestinal zinc transporter ZIP4. This defect impairs the absorption of dietary zinc from the small intestine, leading to systemic zinc deficiency. Clinical signs include periorificial dermatitis, alopecia, chronic diarrhea, and immune dysfunction.

89. (D) Zinc – Male prostate gland and ocular tissues
Zinc is distributed throughout the human body, but it is concentrated in specific tissues. The male prostate gland and ocular tissues, particularly the choroid and retina, contain the highest concentrations of zinc. In these tissues, zinc is essential for cellular structure, enzyme activation, and signaling, whereas iodine is stored in the thyroid.

NODIA

90. (A) Zinc
Hypogeusia, which is a significant reduction in taste sensitivity, and delayed wound healing are classic clinical signs of zinc deficiency. Zinc is a constituent of gustin, a salivary metalloprotein essential for taste bud development. Zinc is also required for collagen synthesis, cell proliferation, and immune function, making it critical for proper wound repair.

91. (B) I, II, and III
Sodium and potassium are crucial electrolytes. Sodium dominates the extracellular fluid, while potassium is the primary intracellular cation. Their concentrations are maintained by the Na+/ K+ ATPase pump, which is vital for membrane potential and nerve transmission. High potassium intake is associated with reduced, rather than increased, risk of developing hypertension.

92. (B) Glutathione peroxidase
Selenium is an essential trace element that exerts its primary antioxidant function as a constituent of selenoproteins. In the form of selenocysteine, it is incorporated into the active site of glutathione peroxidase. This enzyme catalyzes the reduction of toxic hydrogen peroxide and lipid hydroperoxides to water and alcohols, protecting cell membranes.

93. (C) Statement I is correct but Statement II is incorrect.
Fluoride inhibits dental caries by substituting hydroxyl ions in enamel hydroxyapatite to form fluoroapatite, which is more resistant to acid dissolution. However, fluoride is classified as a micromineral or trace element, not a macromineral, because the human body requires it in very small daily amounts, typically under four milligrams.

94. (A) Both A and R are true and R is the correct explanation of A.
Excessive dietary sodium is a key risk factor for essential hypertension. High extracellular sodium concentrations trigger water retention to maintain osmotic balance, expanding extracellular fluid volume. This increase in blood volume elevates cardiac output and venous return. Over time, these changes raise systemic arterial pressure, leading to arterial damage.

95. (D) Chromium functions as an integral structural component of the thyroid hormones.
Trivalent chromium is an essential trace mineral that enhances the physiological action of insulin, likely through a low-molecular-weight oligopeptide complex called chromodulin. Hexavalent chromium is a toxic industrial pollutant. Chromium is not a structural component of thyroid hormones, which are synthesized from iodine and tyrosine residues within thyroglobulin.

96. (C) Glucose and sodium are co-transported across the intestinal epithelium via the SGLT1 transporter, maximizing water absorption.
Oral Rehydration Salts utilize the physiology of active transport in the small intestine. Glucose and sodium are co-transported across the brush-border membrane of enterocytes via the sodium-glucose cotransporter 1. This transport creates an osmotic gradient that drives the rapid absorption of water, reversing the dehydration caused by severe diarrheal disease.

97. (B) P-IV, Q-II, R-I, S-III
Minerals carry out diverse metabolic processes. Selenium functions as a cofactor for glutathione peroxidase to reduce lipid hydroperoxides. Fluoride prevents dental caries by reinforcing enamel. Chromium potentiates insulin action to improve glucose tolerance. Sodium is the major extracellular cation responsible for maintaining extracellular fluid volume and osmotic balance.

98. (D) Highly processed refined meats
Unprocessed plant foods like bananas, potatoes, and citrus fruits are rich sources of dietary potassium. During industrial food processing, refinement, and curing, potassium is lost from cell matrices and is replaced with sodium-based preservatives. Consequently, highly processed refined meats contain low amounts of potassium and extremely high levels of sodium.

99. (A) Mild dental fluorosis – Chalky white mottling or pitting of the enamel
Dental fluorosis is a condition of tooth enamel development caused by excessive fluoride intake during amelogenesis. Mild dental fluorosis is characterized by a chalky white mottling, opacity, or pitting of the enamel surface. Severe chronic toxicity can progress to skeletal fluorosis, which increases bone density but leads to joint stiffness.

Click Here to Buy book on Amazon

100. (C) II, IV, III, I
The renin-angiotensin-aldosterone system responds to low sodium levels. First, the kidneys secrete renin from the juxtaglomerular apparatus. Renin then cleaves angiotensinogen into angiotensin I. Angiotensin-converting enzyme converts angiotensin I into active angiotensin II, which stimulates the adrenal cortex to secrete aldosterone, promoting renal sodium reabsorption.

101. (A) Profound physiological loss of key electrolytes through sweat accompanied by excessive plain water ingestion.
Marathon runners lose substantial amounts of water and sodium through sweat. Consuming large quantities of plain water without electrolyte replacement dilutes the extracellular fluid, leading to acute hyponatremia. This osmotic imbalance causes cellular swelling in the brain, manifesting clinically as muscle cramps, neurological confusion, and physical collapse.

102. (D) A potentially fatal cardiomyopathy occurring primarily in children and young women, associated with severe selenium deficiency.
Keshan disease is an endemic, potentially fatal cardiomyopathy that primarily affects children and young women. It is associated with severe dietary selenium deficiency, which impairs glutathione peroxidase activity and increases oxidative damage to myocardial tissues. The deficiency is often exacerbated by viral co-infections, which trigger acute cardiac dysfunction.

103. (B) Adequate chromium intake enhances the binding of insulin to its receptor, thereby improving intracellular glucose uptake and mitigating insulin resistance.
Chromium functions as a component of chromodulin, an oligopeptide that binds to the insulin receptor. When insulin binds, chromium uptake is stimulated, allowing chromodulin to bind to the intracellular domain of the receptor. This interaction amplifies tyrosine kinase activity, enhancing downstream signaling to promote glucose transport and reduce insulin resistance.

104. (C) Calcium – Intracellular fluid
Electrolytes are unequally distributed across cell membranes. Sodium and chloride are the dominant ions in the extracellular fluid. Potassium is the primary intracellular cation. Although calcium is a key cellular signaling molecule, intracellular free calcium is kept extremely low, with the bulk of physiological calcium stored in extracellular bone matrices.

105. (D) Potassium chloride
To formulate low-sodium salt substitutes, sodium chloride is partially replaced with potassium chloride. Potassium chloride provides a similar salty taste profile without the blood pressure-elevating effects of sodium. Increasing potassium intake also promotes renal sodium excretion and relaxes vascular smooth muscle, helping to lower blood pressure in hypertensive patients.

106. (A) I, II, and III
Mineral bioavailability is influenced by chemical and physiological factors. Gastric acid (low pH) is required to dissolve minerals, converting them into absorbable ionic forms. Aging often decreases gastric acid secretion, impairing calcium and iron absorption. Physiological demand regulates uptake, increasing absorption during deficiency. Dietary fiber generally reduces, rather than enhances, bioavailability.

107. (B) To increase the nutritional value of a staple food to prevent specific micronutrient deficiencies in the general population.
Food fortification is a public health strategy aimed at delivering essential nutrients to broad populations. By adding vitamins or minerals to widely consumed staple foods, fortification programs increase the nutritional value of the diet. This intervention is designed to prevent subclinical deficiencies across the general population, rather than treating acute clinical cases.

108. (B) Fluid cow's milk
Vitamin D fortification is commonly implemented using fluid milk as the vehicle. Because vitamin D is fat-soluble, it is highly stable in the lipid phase of milk, and the natural presence of calcium and phosphorus in dairy products works synergistically with the vitamin to optimize calcium absorption and support skeletal health.

NODIA

109. (A) Both A and R are true and R is the correct explanation of A.
Although spinach contains substantial levels of calcium, its bioavailability is extremely low compared to dairy sources. Spinach contains high concentrations of oxalic acid, which acts as a strong organic chelator. Oxalate binds calcium ions in the intestinal lumen, forming insoluble

calcium oxalate crystals that resist enzymatic digestion and prevent absorption.

110. (A) Both Statement I and Statement II are correct.
Prolonged high-dose zinc supplementation can induce a secondary copper deficiency. High levels of zinc stimulate enterocytes to synthesize the metal-binding protein metallothionein. Because metallothionein has a higher binding affinity for copper than for zinc, it chelates dietary copper, trapping it inside the cells. This copper is then lost when enterocytes are sloughed.

111. (D) Iron and Iodine
Double Fortified Salt combines iron and iodine in a single vehicle to address both anemia and goiter. Developing DFS requires specialized formulation techniques because direct contact between iron compounds and potassium iodate causes the oxidation of iodide to elemental iodine, which volatilizes and leads to a loss of both nutrients.

112. (C) P-III, Q-IV, R-II, S-I
Dietary components alter mineral absorption through distinct chemical interactions. Vitamin C enhances non-heme iron absorption by reducing it to the soluble ferrous state. Phytic acid inhibits zinc, iron, and calcium absorption by forming insoluble chelates. Vitamin D promotes calcium absorption in the gut, while tannins in tea inhibit non-heme iron uptake.

113. (B) Restoration – Adding entirely new, unapproved synthetic vitamins to organic produce.
Nutrient addition terms have precise regulatory definitions. Enrichment involves replacing nutrients lost during processing. Fortification means adding nutrients not originally present. Standardization means adjusting nutrients to meet a regulatory standard. Restoration is defined as adding back nutrients to match original pre-processed levels, not adding unapproved synthetic compounds to organic produce.

114. (D) Citric acid in citrus fruits
Non-heme iron absorption is inhibited by polyphenols in tea, calcium in dairy, and oxalic acid in leafy greens, which form insoluble complexes in the lumen. Conversely, citric acid found in citrus fruits acts as an absorption enhancer. It forms soluble chelates with iron and helps reduce ferric iron to the more absorbable ferrous state.

115. (A) Ascorbic acid reduces Fe^{3+} to Fe^{2+}, which is the soluble form absorbed by the DMT1 transporter.
Ascorbic acid enhances non-heme iron absorption through a specific chemical reaction. It acts as a reducing agent in the duodenum, converting insoluble ferric iron to the soluble ferrous form. This ferrous iron remains stable at duodenal pH, allowing transport across the apical membrane of enterocytes via the divalent metal transporter 1.

116. (C) The "+F" logo is a mandatory declaration on the label of strictly regulated fortified foods.
Under Food Safety and Standards Authority of India regulations, food fortification is standardly regulated. When manufacturers choose to fortify staple foods like oil, milk, or wheat flour according to FSSAI standards, they are legally required to display the "+F" logo on the packaging label as a mandatory declaration of compliance.

117. (A) The proportion of an ingested nutrient that is absorbed, transported, and utilized by the body for metabolic functions.
Bioavailability is a fundamental concept in nutritional science. It is defined as the exact proportion of an ingested nutrient that successfully undergoes intestinal absorption, enters the systemic circulation, and is transported to target tissues where it is utilized for its physiological or metabolic functions within the body.

118. (D) High dietary calcium intake concurrently consumed with iron-rich foods competitively inhibits iron absorption.
Mineral-mineral interactions can inhibit absorption. High dietary calcium intake, when consumed concurrently with iron-rich foods, acts as a competitive inhibitor of iron absorption. Calcium interferes with the transport of both heme and non-heme iron across the enterocyte membrane, likely by affecting the internalization of iron transporters.

119. (B) Wheat Flour (Atta) – Iron, Folic Acid, and Vitamin B12
Under FSSAI regulations, wheat flour fortification is designed to combat nutritional anemias. The standard formulation mandates the addition of iron, folic acid, and vitamin B12. This combination targets multiple causes of anemia, as iron supports hemoglobin synthesis, while folate and cobalamin are required for proper red blood cell development.

Downloaded from www.pdf.tube

120. (C) Decrease in the incidence of neural tube defects (NTDs) in newborns.
The primary public health goal of mandatory flour fortification with folic acid is to reduce the incidence of neural tube defects in newborns. Folic acid is highly essential for nucleotide synthesis and rapid cell division, ensuring proper closure of the neural tube during the first weeks of embryonic development.

121. (D) I, II, and IV
Recommended Dietary Allowances are designed to meet the nutritional needs of nearly all healthy individuals in a demographic. RDAs are derived from Estimated Average Requirements and account for nutrient bioavailability and losses during preparation. Because climate, physical activity, and dietary patterns vary, RDA values are not universally identical across all countries.

122. (A) Peeling of skin, severe headache, and hepatosplenomegaly
Chronic vitamin A toxicity occurs when intake exceeds hepatic storage capacity, leading to tissue damage. It manifests clinically with desquamation or peeling of the skin, bone pain, alopecia, severe headaches from increased intracranial pressure, and hepatosplenomegaly due to excessive accumulation of retinyl esters in liver stellate cells.

123. (C) Statement I is correct but Statement II is incorrect.
Excessive vitamin D intake causes hypercalcemia, which can lead to calcium deposition in soft tissues like the kidneys and blood vessels, damaging these organs. However, vitamin D toxicity cannot occur from sun exposure because ultraviolet radiation also photolyzes excess pre-vitamin D3 and cholecalciferol into inactive photoproducts, preventing overproduction.

124. (A) Both A and R are true and R is the correct explanation of A.
Toxicity from fat-soluble vitamins is more common than from water-soluble vitamins because of differences in metabolism. Fat-soluble vitamins accumulate in the liver and adipose tissue, where they can build up to toxic levels over time. In contrast, excess water-soluble vitamins are generally excreted rapidly in the urine.

125. (A) The UL is intended as a recommended target intake for athletes and pregnant women.
The Tolerable Upper Intake Level is the highest daily intake of a nutrient unlikely to pose a risk of adverse health effects to the general population. As intake exceeds the UL, the risk of toxicity increases. The UL is never a recommended target intake, but rather a safety limit.

126. (C) Vitamin A
Consuming the livers of apex predators like polar bears or seals exposes explorers to toxic doses of vitamin A. These animals store massive quantities of vitamin A in their livers. Ingesting this tissue leads to acute hypervitaminosis A, presenting with severe intracranial pressure, nausea, desquamation, and potential liver failure.

127. (D) P-II, Q-IV, R-I, S-III
Chronic nutrient overconsumption causes specific toxicities. Fluoride excess leads to dental fluorosis and skeletal abnormalities. Iron overload causes tissue deposition and organ damage known as hemochromatosis. Pyridoxine toxicity causes sensory neuropathy, presenting with ataxia, while vitamin D toxicity leads to hypercalcemia, which can cause kidney stone formation.

NODIA

128. (C) Macrocytic anemia
Hemochromatosis is an iron overload disorder where iron deposits in parenchyma, causing tissue damage. This leads to cirrhosis, cardiomyopathy, and diabetes mellitus due to pancreatic damage. Hemochromatosis does not cause macrocytic anemia, which is a hematological disorder typically resulting from folate or cobalamin deficiency, not from iron overload.

129. (B) Vitamin A – Chronic hepatotoxicity and portal tract fibrosis
Vitamin A is stored in hepatic stellate cells. Chronic intake exceeding storage capacity leads to cellular hypertrophy, hyperplasia, and collagen deposition. This manifests as chronic hepatotoxicity and portal tract fibrosis, which can progress to portal hypertension and cirrhosis, whereas water-soluble vitamins are generally excreted without damaging tissues.

130. (D) I, II, III, IV
Vitamin D toxicity progresses through distinct clinical stages. It begins with elevated serum 25-hydroxyvitamin D levels. This causes persistent hypercalcemia and hypercalciuria. Over time,

high blood calcium leads to the calcification of soft tissues, particularly nephrocalcinosis in the kidneys. Continued calcification leads to kidney damage and renal failure.

131. (A) Pyridoxine (B6)
Megadoses of pyridoxine, or vitamin B6, can cause sensory neuropathy. Although water-soluble, high doses of pyridoxine can overwhelm metabolic pathways, leading to the accumulation of pyridoxine, which acts as an antagonist to the active coenzyme form. This causes progressive sensory axon degeneration, presenting as unsteady gait and numbness.

132. (C) An abnormal condition resulting from the excessive and toxic accumulation of a vitamin in the body.
Hypervitaminosis is defined as an abnormal physiological condition resulting from the excessive and toxic accumulation of vitamins in the body. This is most common with fat-soluble vitamins because they are stored in tissues, whereas excess water-soluble vitamins are usually excreted, although megadoses can still cause adverse effects.

133. (A) Excess unbound iron generates highly reactive hydroxyl radicals via the Fenton reaction, leading to lipid peroxidation and severe organ damage.
Iron toxicity is driven by the chemical reactivity of free iron ions. When iron levels exceed the binding capacity of transferrin, unbound iron catalyzes the Fenton reaction, converting hydrogen peroxide into highly reactive hydroxyl radicals. These radicals initiate lipid peroxidation of cell membranes, causing cell death and organ damage.

134. (D) Iron – Requirement is generally higher for adult men than for adult women of reproductive age
Recommended dietary allowances are established based on the physiological requirements of different demographics. Adult women of reproductive age have higher iron requirements than adult men because of blood loss during menstruation. Classifying the iron requirement as higher for men than for reproductive-age women is incorrect.

135. (B) Supplements should generally not exceed the Tolerable Upper Intake Level (UL) unless prescribed for a diagnosed deficiency.
To avoid the risk of nutrient toxicity, dietary supplements should generally not exceed the established Tolerable Upper Intake Level. The UL represents the maximum safe daily intake unlikely to cause adverse health effects. Exceeding this limit increases the risk of toxicity, unless managed under medical supervision.

136. (C) I, III, and IV
India faces significant micronutrient challenges. Iron deficiency anemia remains highly prevalent, particularly among women and children. Zinc deficiency contributes to childhood stunting, and cereal-based diets rich in phytic acid reduce the bioavailability of both minerals. Although iodized salt has greatly reduced goiter, iodine deficiency disorders are not entirely eradicated.

137. (D) Atomic Absorption Spectroscopy (AAS)
Atomic Absorption Spectroscopy is widely recognized as the gold standard for the precise quantitative analysis of trace minerals in food. AAS operates by vaporizing the sample and measuring the absorption of specific wavelengths of light by ground-state atoms, providing high sensitivity and selectivity for elements like lead, cadmium, zinc, and iron.

138. (A) 2,6-Dichlorophenolindophenol (DCPIP)
Ascorbic acid is quantitatively measured in fruit juices using redox titrimetry. The most common titrant used is 2,6-dichlorophenolindophenol, a dye that is blue in alkaline solution and pink in acidic conditions. DCPIP is reduced by ascorbic acid to a colorless compound, and the endpoint is indicated by a persistent light pink color.

139. (A) Both A and R are true and R is the correct explanation of A.
High-Performance Liquid Chromatography is widely used for the simultaneous determination of vitamins in fortified foods. HPLC separates, identifies, and quantifies complex vitamin mixtures by passing the liquid sample through a stationary phase column. This technique offers high sensitivity and specificity when coupled with ultraviolet or fluorescence detection systems.

Click Here to Buy book on Amazon

140. (D) Statement I is incorrect but Statement II is correct.
The Anemia Mukt Bharat strategy is a multi-sectoral public health initiative in India. Statement I is incorrect because the program does not focus exclusively on pregnant women, but rather targets six distinct beneficiary groups across the life cycle. Statement II is correct as the program utilizes the 6x6x6 framework.

141. (A) Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
Inductively Coupled Plasma Mass Spectrometry is the most competent technique for simultaneous multi-elemental profiling. ICP-MS uses a high-temperature argon plasma to atomize and ionize sample elements, which are then separated and quantified by mass spectrometry. This technique offers exceptional sensitivity, low detection limits, and rapid multi-element analysis.

142. (C) P-II, Q-III, R-IV, S-I
Nutritional analyses utilize specialized analytical methods. Sodium and potassium are measured using emission-based flame photometry. Vitamin C is quantified through redox titration with 2,6-DCPIP. Trace minerals and heavy metals are analyzed using atomic absorption spectroscopy, and fat-soluble vitamin A is separated and detected using high-performance liquid chromatography.

143. (D) HPLC – Separates compounds based strictly on their boiling points.
Analytical instruments separate and measure analytes based on distinct physical principles. Gas chromatography, not HPLC, separates compounds based on their boiling points and vapor pressures. HPLC separates analytes in a liquid mobile phase based on their differential partition coefficients between the mobile phase and a solid stationary phase column.

144. (C) Selenium
Micronutrient deficiencies represent a major public health challenge in India. Iron deficiency anemia, iodine deficiency disorders, and zinc deficiency are widely recognized as highly prevalent national health concerns. Selenium deficiency is not considered a major public health concern in India, as soil levels and dietary intakes are generally adequate.

145. (B) The sample must undergo complete wet or dry ashing (digestion) to destroy all organic matter and release the free minerals.)
Analyzing trace minerals in solid food matrices like wheat flour using AAS requires destroying the organic components. The sample must undergo complete wet or dry ashing (acid digestion) to break down carbohydrates, lipids, and proteins. This process releases the bound minerals into an aqueous acidic solution, preventing spectral interferences.

146. (D) Endemic fluorosis is heavily concentrated in states with high natural geological fluoride levels in groundwater, such as Rajasthan, Gujarat, and Andhra Pradesh.
Fluorosis is a major public health concern in India. Endemic fluorosis is heavily concentrated in specific geographical regions with high natural geological levels of fluoride in the groundwater, which is used for drinking. States such as Rajasthan, Gujarat, and Andhra Pradesh are highly affected, presenting with dental and skeletal fluorosis.

147. (A) Measurement of the absorption of specific wavelengths of light by free, unexcited ground-state atoms.
Atomic Absorption Spectroscopy operates on the principle that free, unexcited ground-state atoms in a vaporized sample absorb electromagnetic radiation at specific wavelengths. The amount of light absorbed is directly proportional to the concentration of the element, enabling the precise quantitative determination of trace minerals in a sample.

NODIA

148. (C) Heavy rainfall and glaciation in the Himalayan and sub-Himalayan regions leached iodine from the soil, leading to iodine-deficient crops and endemic goiter.
The historical geographical distribution of goiter in India is linked to geological factors. Heavy rainfall and glaciation in the Himalayan and sub-Himalayan regions leached soluble iodine from the soil over millennia. Consequently, crops grown in these regions were deficient in iodine, leading to endemic iodine deficiency and goiter in these populations.

149. (A) Vitamin B12 – Microbiological assay using Lactobacillus leichmannii
Microbiological assays are highly specific methods used to quantify vitamins based on the growth

requirements of specific bacterial strains. Vitamin B12 is traditionally measured using Lactobacillus leichmannii, a bacterium that requires cobalamin for replication. The growth rate of this organism is directly proportional to the B12 concentration in the sample.

150. (D) The milk was stored in clear, transparent pouches exposed directly to intense sunlight for hours.

Vitamin A is highly sensitive to light-induced degradation. When fortified milk is packaged in clear, transparent pouches and exposed to direct sunlight, ultraviolet and visible wavelengths catalyze the photolysis of retinyl palmitate. This photo-oxidation degrades the vitamin structure, leading to a complete loss of vitamin A content.

www.nodia.in

NODIA

CHAPTER 03

Food Contaminants: Heavy Metals, Pesticides and Adulterants

1. Which of the following best describes a food contaminant under standard food safety guidelines?
(A) Any substance deliberately added to food during processing to enhance its sensory and organoleptic properties.
(B) Any nutrient fortificant intentionally mixed into food products to resolve regional or dietary deficiency diseases.
(C) Any biological, chemical, or physical substance not intentionally added to food that compromises safety or suitability.
(D) Any permissible chemical preservative utilized within recommended regulatory limits to extend shelf life.

2. Which of the following statements is correct regarding the primary sources of heavy metal contamination in the food chain?
(A) Heavy metal contamination exclusively originates from naturally occurring geological formations, soil erosion, and rock weathering.
(B) Anthropogenic activities such as mining, industrial emissions, and agrochemical usage contribute significantly to soil contamination.
(C) Heavy metals in the food chain can be completely eliminated and neutralized during high-temperature thermal processing.
(D) Contamination of agricultural irrigation water with heavy metals rarely translates into bioaccumulation within food crops.

3. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): Chronic consumption of groundwater contaminated with inorganic arsenic is a severe public health concern in regions like the Bengal basin.
Reason (R): Inorganic arsenic undergoes rapid biodegradation in human tissues, preventing long-term systemic toxicity.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

4. Which of the following statements is incorrect regarding the classification of food contaminants?
(A) Intentional food adulterants like brick powder in chili powder are technically classified as incidental contaminants.
(B) Radionuclides incorporated into food via environmental fallout are considered physical contaminants.
(C) Mycotoxins produced by fungal species during agricultural storage are classified as biological contaminants.
(D) Heavy metals and pesticide residues are universally categorized as chemical food contaminants.

5. A food safety laboratory analyzes a sample of rice harvested from a region with high geological arsenic levels. To determine the exact human health risk, the lab must differentiate between the forms of arsenic present. Which concept must the analyst apply?
(A) Determining the total elemental concentration of all arsenic forms present without performing chemical speciation.
(B) Assessing the biological biomagnification factor of the harvested rice sample compared to the surrounding soil.
(C) Quantifying the ratio of toxic inorganic arsenic species to the relatively benign organic arsenic compounds.
(D) Evaluating the cumulative synergistic toxicity of arsenic when combined with residual organophosphate pesticides.

6. Match List I with List II:

Downloaded from www.pdf.tube

List I: (Contaminant Category)
P. Heavy Metal
Q. Organochlorine Pesticide
R. Common Adulterant
S. Endocrine Disruptor
List II: (Specific Example)
I. Metanil Yellow
II. Bisphenol A
III. Cadmium
IV. Dieldrin
Which of the following is the correct match?
(A) P-III, Q-IV, R-I, S-II
(B) P-IV, Q-III, R-II, S-I
(C) P-III, Q-I, R-IV, S-II
(D) P-II, Q-IV, R-I, S-III

7. Which of the following is NOT a recognized major source of arsenic contamination in the agricultural food chain?
(A) Use of arsenic-contaminated groundwater for crop irrigation.
(B) Historical use of arsenical pesticides and herbicides.
(C) Emissions from volcanic eruptions and natural weathering of arsenic-bearing minerals.
(D) Biodegradation of complex carbohydrate polymers in soil organic matter.

8. Given below are two statements:
Statement I: The primary toxicity mechanism of arsenic involves its high affinity for sulfhydryl (-SH) groups of cellular enzymes.
Statement II: By binding to these enzymes, arsenic uncouples oxidative phosphorylation and disrupts cellular energy production.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

9. Consider the following statements regarding the health effects of chronic Arsenic exposure:
1. It primarily causes severe acute neurotoxicity leading to immediate paralysis.
2. It is strongly associated with characteristic skin lesions, including hyperkeratosis.
3. Long-term exposure significantly increases the risk of skin, lung, and bladder cancers.
4. "Blackfoot disease" is a severe peripheral vascular manifestation associated with arsenic poisoning.

Which of the statements given above are correct?
(A) 1, 2, and 3
(B) 2, 3, and 4
(C) 1, 3, and 4
(D) 1, 2, and 4

10. Identify the correct pair regarding arsenic speciation and its relative toxicity.
(A) Arsenobetaine – Highly toxic organic form
(B) Arsenate (As V) – Non-toxic synthetic form
(C) Arsenosugars – The most lethal chemical species
(D) Arsenite (As III) – Highly toxic inorganic form

NODIA

11. A rural population dependent on tube wells begins showing widespread signs of skin pigmentation changes, hyperkeratosis on the palms and soles, and an increased incidence of peripheral gangrene. What is the most likely food or water contaminant responsible for this outbreak?
(A) Arsenic
(B) Cadmium
(C) Lead
(D) Mercury

12. The accumulation of arsenic in human tissues disrupts cellular respiration. What is the direct biochemical effect causing this disruption?
(A) Overstimulation of acetylcholinesterase activity.
(B) Inhibition of the pyruvate dehydrogenase complex.
(C) Denaturation of essential fatty acids in the cell membrane.
(D) Saponification of lipid bilayers in mitochondrial membranes.

13. Identify the incorrect pair regarding heavy metals and their primary historical or industrial sources in the food chain.
(A) Lead – Leaded gasoline and old paint formulations
(B) Arsenic – Improper disposal of polyvinyl chloride (PVC) plastics
(C) Cadmium – Phosphate fertilizers and Ni-Cd battery disposal
(D) Mercury – Industrial chlor-alkali plants and

artisanal gold mining

14. During an agricultural field inspection adjacent to a coal-fired power plant where fly ash deposition is suspected of contaminating the soil, which specific panel of heavy metals should be prioritized for laboratory analysis in the harvested crops?
(A) Arsenic, Lead, and Mercury
(B) Calcium, Magnesium, and Potassium
(C) Cobalt, Copper, and Zinc
(D) Aluminum, Iron, and Manganese

15. Arrange the following stages in the correct sequence to illustrate the bioaccumulation and biomagnification of a heavy metal in an aquatic food chain:
1. Uptake and retention by zooplankton
2. Biomagnification in apex predatory birds
3. Absorption by phytoplankton from contaminated water
4. Ingestion and concentration by small planktivorous fish

Which of the following is correct?
(A) 3, 1, 4, 2
(B) 1, 3, 4, 2
(C) 3, 4, 1, 2
(D) 1, 4, 3, 2

16. Which specific disease is historically associated with chronic environmental exposure to Cadmium, characterized by severe osteomalacia and renal tubular dysfunction?
(A) Minamata disease
(B) Plumbism
(C) Blackfoot disease
(D) Itai-Itai disease

17. Which of the following statements is correct regarding the toxicokinetics of Cadmium in the human body?
(A) Cadmium is rapidly excreted through the human gastrointestinal and biliary systems within 24 hours of exposure.
(B) Cadmium easily crosses the blood-brain barrier, making acute central nervous system damage its primary effect.
(C) Cadmium accumulates primarily in the liver and kidneys, exhibiting a biological half-life of 10 to 30 years.
(D) Cadmium toxicity can be easily reversed by standard dietary supplementation with therapeutic doses of Vitamin C.

18. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): Lead toxicity is particularly dangerous for infants and young children compared to adults.
Reason (R): Children absorb a higher percentage of ingested lead, and their developing nervous systems are highly vulnerable to lead-induced cognitive impairment.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

19. Which of the following statements is incorrect concerning Lead (Pb) exposure and toxicity?
(A) Lead can easily contaminate processed foods through the commercial use of lead-soldered cans and lead-glazed ceramic cookware.
(B) Chronic or acute lead exposure primarily targets the human central nervous system and the physiological hematopoietic system.
(C) Lead can be readily transferred from an exposed pregnant mother directly to her developing fetus across the placental barrier.
(D) The body readily metabolizes absorbed elemental lead into harmless organic compounds that are quickly exhaled through the lungs.

20. A community relies heavily on traditional ceramic cookware with brightly colored glazes. Recently, several children in the community have been diagnosed with unexplained anemia and developmental delays. Which testing protocol should be implemented to identify the toxicant?
(A) Test the cooked food and ceramic leaching for Lead using standard acidic extraction methods.
(B) Test the ceramic glazes for Cadmium leaching using specific standardized weak basic solutions.
(C) Test the cookware for gaseous Mercury volatilization during high-temperature domestic heating.
(D) Test the prepared food samples for high concentration levels of benign organic Arsenic species.

Click Here to Buy book on Amazon

21. Match List I with List II:
List I: (Heavy Metal)
P. Lead
Q. Cadmium
R. Methylmercury
S. Inorganic Arsenic
List II: (Target Organ / Primary Toxicity)
I. Renal cortex and bone (Osteomalacia)
II. Central nervous system (Cognitive deficits)
III. Skin (Keratosis) and cardiovascular system
IV. Central nervous system (Minamata disease)
Which of the following is the correct match?
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-IV, R-I, S-III

22. Which of the following is NOT a common dietary or environmental route for Cadmium exposure?
(A) Ingestion of deep-sea pelagic fish containing high levels of methylmercury.
(B) Dietary consumption of marine bivalve mollusks and coastal crustaceans.
(C) Direct or passive inhalation of tobacco smoke in urban environments.
(D) Consumption of agricultural crops grown with high-cadmium phosphate fertilizers.

23. Given below are two statements:
Statement I: Inorganic mercury released into aquatic environments can be biotransformed into methylmercury by sulfate-reducing bacteria.
Statement II: Methylmercury is highly lipophilic and readily biomagnifies up the aquatic food chain, leading to high concentrations in top predator fish.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

24. Consider the following statements regarding Minamata disease:
1. It is a severe neurological syndrome caused by severe lead poisoning.
2. It was first discovered in Japan due to the release of methylmercury in industrial wastewater.
3. Symptoms include ataxia, numbness in hands and feet, general muscle weakness, and damage to hearing and speech.
4. Congenital Minamata disease occurs when the toxicant crosses the placenta, affecting fetal development.
Which of the statements given above are correct?
(A) 1, 2, and 3
(B) 2, 3, and 4
(C) 1, 3, and 4
(D) 1, 2, and 4

NODIA

25. Identify the correct pair regarding heavy metals and their primary biomarker of exposure.
(A) Cadmium – Hair follicle analysis for measuring short-term acute exposure
(B) Mercury – Volatile breath analysis utilizing standard gas chromatography
(C) Lead – Blood lead levels (BLL) and erythrocyte protoporphyrin
(D) Arsenic – Fasting blood glucose levels and serum insulin concentrations

26. A coastal fishing community consumes large quantities of large predatory fish like shark and swordfish. Several adults present with sensory impairment, ataxia, and visual field constriction. What is the most probable toxicant responsible for this clinical picture?
(A) Inorganic arsenic
(B) Hexavalent chromium
(C) Elemental lead
(D) Methylmercury

27. The chronic accumulation of Cadmium in the proximal tubules of the kidney primarily leads to which physiological outcome?
(A) Low molecular weight proteinuria, specifically increased excretion of beta-2-microglobulin.
(B) Excessive systemic retention of physiological calcium ions leading directly to acute hypercalcemia.
(C) Immediate cessation of renal urine production (anuria) upon initial contact with the heavy metal.
(D) Enhanced active tubular reabsorption of essential dietary amino acids and cellular glucose.

28. Identify the incorrect pair regarding heavy metals and their characteristic biochemical mechanisms.
(A) Lead – Direct inhibition of ALAD and ferrochelatase enzymes in metabolic heme

synthesis
(B) Hexavalent Chromium – Acting as a potent neurotoxin by blocking cellular acetylcholine receptors
(C) Methylmercury – High binding affinity for sulfhydryl groups in physiological nervous tissue proteins
(D) Cadmium – Mimicking essential zinc and calcium ions in cellular and biochemical processes

29. When advising pregnant women on safe dietary practices, which recommendation is most appropriate regarding fish consumption to minimize heavy metal risk?
(A) Avoid all seafood completely due to the widespread environmental presence of highly toxic inorganic arsenic.
(B) Limit large predatory fish due to methylmercury biomagnification, choosing smaller, lower-trophic fish.
(C) Consume only apex predator fish like marlin and king mackerel because they possess much higher protein content.
(D) Only consume fish raw to prevent the physical formation of toxic heavy metal complexes during thermal cooking.

30. Which of the following is the most appropriate indicator for assessing chronic, long-term exposure to Lead in the human body?
(A) Analysis of lead content in bone tissues using X-ray fluorescence.
(B) Measurement of lead levels in a standardized single spot urine sample.
(C) Estimation of biological lead concentration in collected dermal sweat.
(D) Measurement of unbound free lead in unstimulated physiological saliva.

31. Which oxidation state of Chromium is considered highly toxic, mutagenic, and carcinogenic due to its ability to easily cross cell membranes?
(A) Chromium (II)
(B) Chromium (III)
(C) Chromium (VI)
(D) Elemental Chromium (0)

32. Which of the following statements is correct regarding regulatory permissible limits of heavy metals in food?
(A) Food safety regulations mandate a universal zero-tolerance limit for all heavy metals in all food categories.
(B) The permissible limits for heavy metals under standard regulations are strictly voluntary guidelines for manufacturers.
(C) Regulations set the limits exclusively based on the detection limits of analytical instruments, regardless of health risks.
(D) Permissible limits are established based on the food matrix, toxicological data, and standard dietary exposure assessments.

33. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): The concentration of hydrophobic contaminants like organochlorines increases significantly at higher trophic levels in a food web.
Reason (R): Biomagnification occurs because these substances are poorly metabolized, highly lipophilic, and passed efficiently from prey to predator.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

34. Which of the following statements is incorrect regarding the international food safety guidelines and standards for food contaminants?
(A) They set internationally recognized Maximum Levels (MLs) for contaminants in food and feed.
(B) International guidelines legally override all national food safety laws automatically upon publication.
(C) Their standards are used as reference points in international trade disputes by the World Trade Organization (WTO).
(D) They develop codes of practice for the reduction of specific contaminants in the food chain.

35. A laboratory analyzes pesticide residues in a lake ecosystem. They find the concentration in water is 0.001 ppm, in zooplankton is 0.05 ppm, in small fish is 2 ppm, and in osprey (birds) is 25 ppm. This progressive increase in concentration demonstrates which principle?
(A) Bioremediation

Downloaded from www.pdf.tube

(B) Bioaccumulation
(C) Biosynthesis
(D) Biomagnification

36. Match List I with List II:
List I: (Regulatory Term)
P. Bioaccumulation
Q. Biomagnification
R. Maximum Residue Limit (MRL)
S. Tolerable Daily Intake (TDI)
List II: (Definition)
I. The highest level of a pesticide residue legally tolerated in or on food.
II. The estimate of the amount of a contaminant in food that can be ingested daily over a lifetime without appreciable health risk.
III. The gradual build-up of a chemical in a single organism over time.
IV. The increasing concentration of a toxic substance in the tissues of organisms at successively higher levels in a food chain.
Which of the following is the correct match?
(A) P-III, Q-IV, R-I, S-II
(B) P-IV, Q-III, R-II, S-I
(C) P-III, Q-I, R-IV, S-II
(D) P-II, Q-IV, R-I, S-III

37. Which of the following is NOT a characteristic that promotes the biomagnification of a contaminant in a food chain?
(A) High lipid solubility (lipophilicity)
(B) Resistance to biological degradation
(C) High water solubility (hydrophilicity)
(D) Slow rate of excretion from the organism

38. Given below are two statements:
Statement I: Chromium (III) is an essential trace element required for normal lipid and glucose metabolism in humans.
Statement II: Food processing techniques like cooking in stainless steel utensils can contribute to the dietary intake of Chromium.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

39. Consider the following statements regarding regulatory standards for heavy metals in food:
1. National food safety regulations govern the permissible limits of contaminants, toxins, and residues.
2. The limit for Lead in infant formula is kept significantly lower than in adult food products.
3. Foods naturally exceeding the permissible limits due to high soil background levels are exempt from regulatory action.
4. Heavy metal testing is a mandatory requirement for issuing a certificate of analysis for export/import.
Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 2, 3, and 4
(C) 1, 3, and 4
(D) 1, 2, and 3

40. Identify the correct pair regarding heavy metal dynamics in biological systems.
(A) Bioaccumulation – The continuous decrease of a toxic chemical's concentration over the lifespan of an organism.
(B) Bioconcentration – Uptake of contaminants exclusively from surrounding water, completely independent of dietary food.
(C) Biomagnification – The progressive biological dilution of hazardous toxins as they move up successive food chain levels.
(D) Biotransformation – The physical or chemical binding of dissolved heavy metals to external protective bacterial cell walls.

NODIA

41. A research study on an estuarine ecosystem reveals that local oysters contain high levels of cadmium, while the surrounding water has almost undetectable levels. However, the predatory birds eating the oysters do not show proportionately higher levels of cadmium in their tissues. This indicates that cadmium in this specific scenario is undergoing:
(A) Rapid physiological biomagnification throughout the food chain but extremely low individual bioaccumulation.
(B) Complete enzymatic biodegradation of the metal by the oysters, preventing transfer to the bird predators.
(C) Bioaccumulation in oysters without significant biomagnification in the tissues of the consuming birds.
(D) Selective chemical precipitation and

excretion of the metal within the bird's gastrointestinal tract.

42. What is the primary biochemical reason that organochlorine pesticides exhibit high bioaccumulation potential in animal tissues?
(A) They are structurally similar to essential physiological amino acids and are incorporated directly into cellular proteins.
(B) They are highly volatile organic compounds that accumulate rapidly and exclusively within the pulmonary respiratory tract.
(C) They bind completely and irreversibly to essential hemoglobin transport molecules inside circulating red blood cells.
(D) They possess high lipophilicity and resist enzymatic degradation, storing extensively in physiological adipose tissue.

43. Identify the incorrect pair regarding permissible limit terminology.
(A) MRL – Minimum Required Limit, the lowest amount of nutrient that must be present in food
(B) ADI – Acceptable Daily Intake for intentionally added chemicals like additives and pesticides
(C) PTWI – Provisional Tolerable Weekly Intake, typically used for cumulative heavy metals
(D) ALARA – As Low As Reasonably Achievable, a principle for managing unavoidable contaminants

44. A batch of packaged drinking water is found to have a Lead concentration of 0.05 mg/L. If the standard regulatory permissible limit for Lead in packaged drinking water is 0.01 mg/L, what is the appropriate regulatory action?
(A) Approve the batch since a concentration of 0.05 mg/L is considered a trace amount and completely harmless.
(B) Reject the batch and initiate recall or enforcement action for exceeding the statutory permissible limit.
(C) Advise the manufacturing company to boil the water to successfully remove and precipitate the lead before sale.
(D) Blend the contaminated batch with high-purity water until the overall mixture reaches exactly 0.05 mg/L.

45. Arrange the following regulatory steps in the logical sequence used to establish Maximum Residue Limits (MRLs) for pesticides in food:
1. Determine the Acceptable Daily Intake (ADI) based on toxicological studies.
2. Conduct supervised field trials to determine residue levels under Good Agricultural Practices (GAP).
3. Conduct risk characterization by comparing estimated dietary exposure with the ADI.
4. Propose and legally adopt the MRL if the dietary exposure is deemed safe.

Which of the following is correct?
(A) 2, 1, 3, 4
(B) 1, 2, 3, 4
(C) 3, 1, 2, 4
(D) 2, 3, 1, 4

46. Based on their target organism, pesticides are broadly classified. Which category is specifically designed to control competitive unwanted plant growth in agricultural fields?
(A) Herbicides
(B) Insecticides
(C) Fungicides
(D) Nematicides

47. Which of the following statements is correct regarding the chemical classification of insecticides?
(A) Organophosphates are characterized by their extreme environmental persistence, often lasting decades in the soil.
(B) Organochlorines exert their toxic effect primarily by reversibly inhibiting acetylcholinesterase.
(C) Pyrethroids are synthetic derivatives of naturally occurring botanical compounds found in chrysanthemum flowers.
(D) Neonicotinoids are primarily used as fumigants for stored grain protection due to their high volatility.

48. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): Organochlorine pesticides like DDT have been banned or strictly restricted globally under the Stockholm Convention.
Reason (R): Organochlorines are highly persistent in the environment, bioaccumulate in food chains, and pose long-term chronic toxicity risks.

Click Here to Buy book on Amazon

Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

49. Which of the following statements is incorrect regarding fungicides?
(A) Fungicides are utilized to control mycological diseases in crops, such as rusts and mildews.
(B) The use of fungicides can help reduce the incidence of mycotoxin contamination in harvested cereals.
(C) All fungicides act exclusively by disrupting the nervous system of the fungal pathogen.
(D) Some fungicides act systemically, being absorbed and distributed throughout the plant tissues.

50. When monitoring food products for pesticide residues where an organophosphate pesticide was used, what primary toxicological mechanism of concern should be prioritized during the residue risk assessment?
(A) Direct block and disruption of voltage-gated calcium channels in cardiac muscle cells.
(B) Irreversible inhibition of acetylcholinesterase, leading to systemic acetylcholine accumulation.
(C) Specific enzymatic interference with the fungal membrane ergosterol biosynthesis pathway.
(D) Direct physical alkylation of cellular DNA leading to immediate and severe teratogenic effects.

51. Match List I with List II:
List I: (Pesticide Chemical Class)
P. Organochlorine
Q. Organophosphate
R. Carbamate
S. Herbicide (Phenoxy class)
List II: (Specific Example)
I. Aldicarb
II. 2,4-D
III. Malathion
IV. Endosulfan
Which of the following is the correct match?
(A) P-IV, Q-III, R-I, S-II
(B) P-III, Q-IV, R-II, S-I
(C) P-IV, Q-I, R-III, S-II
(D) P-I, Q-II, R-IV, S-III

52. Which of the following is NOT a characteristic of Organochlorine pesticides?
(A) Low lipid solubility resulting in rapid excretion in urine
(B) High stability against chemical and biological degradation
(C) Potential to cause disruption of the endocrine system
(D) Historic widespread use followed by global regulatory phase-outs

53. Given below are two statements:
Statement I: Organophosphate pesticides degrade more rapidly in the environment compared to organochlorines, reducing their potential for bioaccumulation.
Statement II: However, organophosphates generally possess higher acute toxicity to mammals, posing significant risks of acute poisoning to agricultural workers.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

54. Consider the following statements regarding Maximum Residue Limits (MRL) for pesticides:
1. MRLs are toxicological safety limits representing the maximum amount a human can consume without harm.
2. MRLs are established based on Good Agricultural Practices (GAP) and represent the maximum expected residue when the pesticide is used correctly.
3. If a food product exceeds the MRL, it does not automatically mean it presents an acute health risk, but it does indicate a violation of GAP.
4. MRLs are universally identical across all countries for a specific pesticide-crop combination.

Which of the statements given above are correct?
(A) 1 and 4
(B) 2 and 3
(C) 1, 2, and 3
(D) 2, 3, and 4

Downloaded from www.pdf.tube

55. Identify the correct pair regarding the pesticide and its primary target action.
(A) Herbicides – Chemical inhibition of the acetylcholinesterase enzyme inside broadleaf weeds.
(B) Fungicides – Direct stimulation of excessive, lethal growth hormone within target fungal spores.
(C) Rodenticides – Blocking light-dependent photosynthesis pathways in target wild rodent species.
(D) Insecticides – Selective disruption of the nervous system or cuticle formation in target insects.

56. A farm worker is brought to a rural clinic presenting with excessive salivation, pinpoint pupils (miosis), muscle fasciculations, and respiratory distress shortly after spraying a field. Based on the cholinergic toxidrome, exposure to which class of pesticide is most probable?
(A) Organochlorines
(B) Organophosphates
(C) Botanical pyrethrins
(D) Triazine herbicides

57. The widespread historical use of DDT caused severe declines in populations of apex predatory birds like the bald eagle. What was the direct physiological cause-effect relationship responsible for this population decline?
(A) DDT acted as a potent neurotoxin leading to severe adult bird paralysis and loss of coordination during flight.
(B) DDT caused widespread structural sterility by rapidly destroying functional seminiferous tubules in male birds.
(C) DDE (a metabolite of DDT) caused the thinning of eggshells by inhibiting calcium ATPase in the shell gland.
(D) DDT bioaccumulated in pulmonary tissues, causing acute and fatal respiratory distress syndrome in young birds.

58. Identify the incorrect pair regarding pesticide analysis techniques.
(A) Gas Chromatography (GC) – Highly suitable for separating and analyzing volatile and semi-volatile pesticide residues.
(B) High-Performance Liquid Chromatography (HPLC) – Preferred for analyzing thermally unstable and non-volatile pesticides.
(C) Mass Spectrometry (MS) – Used as a robust detector providing definitive chemical structural identification and quantification.
(D) Thin Layer Chromatography (TLC) – The highly sensitive, modern gold-standard for quantifying pesticide residues at trace levels.

59. When evaluating the safety of a new systemic pesticide intended for crop application, which vital piece of toxicological data must be established first to calculate the Acceptable Daily Intake (ADI)?
(A) The No Observed Adverse Effect Level (NOAEL) in chronic animal toxicity studies.
(B) The regulatory Maximum Residue Limit (MRL) established for high-risk crop categories.
(C) The predicted biological biomagnification factor across diverse aquatic ecosystems.
(D) The specific lethal dose required to kill exactly 100% of target insect pests (LD100).

60. Which of the following extraction and clean-up methodologies is currently considered the most appropriate, rapid, and widely used standard for multi-residue pesticide analysis in food commodities?
(A) Soxhlet extraction
(B) QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe)
(C) Liquid-Liquid Extraction using massive volumes of chlorinated solvents
(D) Supercritical Fluid Extraction strictly utilizing heated water

61. How is the Maximum Residue Limit (MRL) of a pesticide legally defined in the context of food safety?
(A) The minimum concentration of an active chemical pesticide required to protect growing crops from target insect pests.
(B) The maximum concentration of a pesticide residue legally permitted in or on food and agricultural commodities.
(C) The physiological toxic threshold at which acute pesticide poisoning and clinical symptoms occur in exposed humans.
(D) The absolute minimum limit of detection of the primary analytical instrument utilized in the testing laboratory.

62. Which of the following statements is correct regarding the impact of food processing on pesticide residues?

NODIA

(A) Standard unit operations like washing, peeling, and blanching generally reduce surface contact pesticide residues.
(B) Thermal food processing operations like boiling or baking always increase the chemical toxicity of all pesticide residues.
(C) Standard commercial fermentation processes completely synthesize new and highly toxic chlorinated chemical compounds.
(D) Cold storage and freezing rapidly degrade most systemic pesticides into completely harmless compounds within 24 hours.

63. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): The Acceptable Daily Intake (ADI) of a pesticide is always numerically higher than the Maximum Residue Limit (MRL) allowed on a single food item.
Reason (R): ADI represents a lifetime daily exposure threshold for overall dietary intake, whereas MRL is a specific trade standard based on agricultural field trials, typically set much lower than safety limits to reflect Good Agricultural Practice.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

64. Which of the following statements is incorrect regarding pesticide residue analysis?
(A) Sample homogenization is a critical initial step to ensure a representative analytical sample.
(B) Matrix effects in mass spectrometry can cause signal enhancement or suppression, leading to inaccurate quantification.
(C) An internal standard is often added to the sample to correct for analyte losses during extraction and cleanup.
(D) Multi-residue methods (MRMs) are incapable of detecting more than one class of pesticide simultaneously.

65. A regulatory body is assessing the dietary risk of a pesticide residue on apples. They multiply the established MRL by the average daily consumption of apples by children. This calculation provides an estimate of:
(A) Acceptable Daily Intake (ADI)
(B) No Observed Adverse Effect Level (NOAEL)
(C) Theoretical Maximum Daily Intake (TMDI)
(D) Acute Reference Dose (ARfD)

66. Match List I with List II:
List I: (Toxicological Term)
P. Acute Toxicity
Q. Chronic Toxicity
R. Teratogenicity
S. Carcinogenicity
List II: (Definition)
I. Ability of a substance to cause cancer over time.
II. Adverse effects occurring following continuous, long-term exposure to a substance.
III. Ability of a substance to cause structural malformations in a developing fetus.
IV. Adverse effects occurring within a short time (usually 24 hours) after a single or multiple doses.
Which of the following is the correct match?
(A) P-IV, Q-II, R-III, S-I
(B) P-II, Q-IV, R-I, S-III
(C) P-IV, Q-III, R-II, S-I
(D) P-I, Q-II, R-III, S-IV

67. Which of the following is NOT an advantage of the QuEChERS method in pesticide residue analysis?
(A) High sample throughput during laboratory extraction due to significantly simplified steps.
(B) Significant reduction in the volume of highly toxic organic solvents used during cleanup.
(C) High recovery rates and excellent reproducibility for a wide polarity range of pesticides.
(D) Complete elimination of the need for any analytical instrumentation like GC-MS or LC-MS.

68. Given below are two statements:
Statement I: Endocrine-disrupting pesticides (EDPs) can mimic, block, or interfere with natural hormones in the human body.
Statement II: EDPs typically follow a strict linear dose-response curve, meaning they only exert adverse effects at extremely high doses.
Which of the following is correct?

Click Here to Buy book on Amazon

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

69. Consider the following statements regarding Endocrine Disrupting Chemicals (EDCs) in pesticides:
1. They can alter reproductive function and development in humans and wildlife.
2. Atrazine and Vinclozolin are widely cited examples of pesticides with endocrine-disrupting properties.
3. Their effects can sometimes manifest at very low doses that are below standard toxicological thresholds (NOAEL).
4. EDCs exclusively target the thyroid gland, leaving sex hormones unaffected.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 1, 2, and 3
(D) 2, 3, and 4

70. Identify the correct pair regarding the pesticide and its noted chronic health effect.
(A) Glyphosate – Subject of extensive global debate and IARC classification regarding its potential carcinogenicity.
(B) DDT – Known to disrupt major physiological processes, causing immediate and acute renal failure within minutes.
(C) Malathion – Causes rapid, systemic, and progressive calcification and ossification of internal soft tissues.
(D) Aldrin – Primarily acts as a highly toxic essential nutrient mimic, directly causing severe hypervitaminosis.

71. A shipment of basmati rice designated for export is rejected by an importing country due to the detection of Tricyclazole residues at 0.05 mg/kg, exceeding their import MRL of 0.01 mg/kg. The exporter claims the residue is below the domestic MRL of 1.0 mg/kg. What does this case illustrate?
(A) That analytical testing instruments in food laboratories are inherently faulty and require calibration.
(B) That Tricyclazole represents a substance that is universally highly toxic to human health at 0.05 mg/kg.
(C) The immediate and urgent need to ban Tricyclazole globally under international treaties.
(D) The lack of international harmonization of MRLs, requiring exporters to comply with destination regulations.

72. Chronic low-dose exposure to certain pesticides over decades has been epidemiologically linked to the degeneration of dopaminergic neurons in the substantia nigra. This cause-effect relationship highlights the risk of pesticides contributing to which disease?
(A) Alzheimer's disease
(B) Parkinson's disease
(C) Multiple Sclerosis
(D) Huntington's disease

73. Identify the incorrect pair regarding health effects and their duration.
(A) Acute Effect – Nausea and vomiting immediately following accidental ingestion of a pesticide
(B) Chronic Effect – Development of hepatic tumors after 20 years of low-level dietary exposure
(C) Chronic Effect – Dizziness occurring 10 minutes after inhaling fumigant gas
(D) Acute Effect – Contact dermatitis immediately after handling a fungicide formulation

NODIA

74. During a dietary risk assessment for a newly registered pesticide, if the Estimated Daily Intake (EDI) for the local population significantly exceeds the Acceptable Daily Intake (ADI), what is the most appropriate regulatory recommendation?
(A) Recommend an immediate regulatory increase in the toxicological ADI threshold to match the estimated EDI.
(B) Approve the pesticide registration and use because the calculated EDI is merely a theoretical hazard model.
(C) Mandate that the local consumer population significantly increase their daily water intake to flush out residues.
(D) Recommend stringent mitigation measures, lowering of MRLs, or restricted use of the pesticide to reduce EDI.

75. Arrange the primary steps of the QuEChERS analytical method in the correct sequential order:
1. Addition of extraction salts (e.g., NaCl, MgSO4) to induce phase separation.
2. Dispersive Solid Phase Extraction (d-SPE) cleanup using sorbents like PSA or C18.
3. Weighing the homogenized food sample and adding an organic solvent (typically Acetonitrile).
4. Chromatographic analysis (GC-MS or LC-MS) of the final extract.

Which of the following is correct?
(A) 3, 1, 2, 4
(B) 1, 3, 2, 4
(C) 3, 2, 1, 4
(D) 1, 2, 3, 4

76. What is the fundamental definition of a food adulterant under food safety laws?
(A) Any harmless coloring agent or texturizer added to make processed food visually more appealing to consumers.
(B) Any material used or designed to make food unsafe, sub-standard, misbranded, or contain extraneous matter.
(C) Any naturally occurring hazardous heavy metal or chemical compound found in trace baseline amounts in soil.
(D) A synthetic nutrient or vitamin complex artificially added to food batches to combat regional malnutrition.

77. Which of the following statements is correct regarding the types of food adulteration?
(A) Intentional adulteration is defined as the deliberate addition of prohibited chemicals to elevate the visual appearance.
(B) Incidental adulteration involves the accidental inclusion of contaminants like metallic shavings or insect fragments.
(C) Economically Motated Adulteration is primarily driven by the intent to cause public health harm rather than financial gain.
(D) Metallic contamination refers to the natural leaching of trace copper or iron elements from standard packaging.

78. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): The addition of urea and detergents to synthetic milk is a severe form of intentional adulteration.
Reason (R): These chemicals are added to increase the fat content naturally produced by the bovine mammary gland.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

79. Which of the following statements is incorrect concerning common food adulterants?
(A) Starch is frequently added to milk to artificially boost the Solid-Not-Fat (SNF) reading.
(B) Argemone oil is often mixed with mustard oil due to their similar appearance and lower cost.
(C) Metanil yellow is an approved, safe, food-grade dye legally permitted in turmeric powder.
(D) Papaya seeds are commonly used to adulterate black pepper due to morphological similarities.

80. A vendor is suspected of substituting expensive pure ghee with cheaper hydrogenated vegetable oils (Vanaspati). Which chemical test should a food analyst apply to detect this specific adulteration?
(A) Iodine Test
(B) Nitric Acid Test
(C) Benedict's Test
(D) Baudouin Test

81. Match List I with List II:
List I: (Food Item)
P. Black Pepper
Q. Chili Powder
R. Coriander Powder
S. Honey
List II: (Common Adulterant)
I. High Fructose Corn Syrup / Invert Sugar
II. Papaya seeds
III. Brick powder / Sudan Red dye
IV. Sawdust / Horse dung powder
Which of the following is the correct match?
(A) P-II, Q-III, R-IV, S-I
(B) P-III, Q-II, R-I, S-IV
(C) P-II, Q-IV, R-III, S-I
(D) P-I, Q-III, R-IV, S-II

Downloaded from www.pdf.tube

82. Which of the following is NOT a consequence of acute toxicity from consuming adulterated food?
(A) Immediate severe gastrointestinal distress
(B) Gradual development of atherosclerosis over 20 years
(C) Sudden outbreak of Epidemic Dropsy
(D) Acute renal failure following consumption of melamine-tainted milk

83. Given below are two statements:
Statement I: Food fraud is a broader concept that includes the deliberate substitution, addition, tampering, or misrepresentation of food for economic gain.
Statement II: Accidental contamination, such as a localized pest infestation in a warehouse, is legally prosecuted as deliberate Food Fraud.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

84. Consider the following substances often found in milk:
1. Water
2. Formalin
3. Hydrogen Peroxide
4. Starch
Which of these are classified as chemical adulterants intentionally used to increase shelf-life (preservatives)?
(A) 1 and 4
(B) 2 and 3
(C) 1, 2, and 4
(D) 2, 3, and 4

85. Identify the correct pair regarding the detection of adulterants in milk.
(A) Detection of Urea – Adding specialized urease reagent yields an intense green color change.
(B) Detection of Water – Measuring physical specific gravity utilizing a standard portable hydrometer.
(C) Detection of Starch – Adding iodine solution to the sample produces a characteristic blue color.
(D) Detection of Detergent – Vigorous mechanical shaking of the milk sample produces a persistent foam layer.

86. A community experiences a sudden spike in cases of bilateral pitting edema, erythema, and breathlessness. Epidemiological investigation links the outbreak to the consumption of locally pressed mustard oil. What is the most likely cause?
(A) Adulteration with Argemone mexicana seed oil
(B) Adulteration with mineral oil
(C) Contamination with Aflatoxin B1
(D) Rancidity due to prolonged storage in sunlight

87. What is the primary economic cause-effect driver behind the adulteration of high-value spices like saffron and cardamom?
(A) The complete lack of consumer demand for pure spices forces local vendors to add chemical bulk to elevate sales volume.
(B) The rapid natural degradation of stored spices requires the continuous addition of synthetic chemicals to maintain color.
(C) Highly lucrative and strict government subsidies on synthetic dyes make them significantly cheaper to use than organic farming.
(D) High cultivation costs and intensive labor drive unethical vendors to substitute with cheap, morphologically similar materials.

88. Identify the incorrect pair regarding adulterants and their potential health hazards.
(A) Lead Chromate (in Turmeric) – Anemia, neurological damage, and reproductive toxicity
(B) Chicory (in Coffee) – Potent acute neurotoxin causing immediate paralysis
(C) Sudan Dyes (in Chili powder) – Known carcinogenicity
(D) Melamine (in Milk) – Severe kidney stones and renal failure

89. When inspecting silver foil (vark) used on sweets, what is the most rapid, rudimentary field test to differentiate pure silver foil from aluminum foil?
(A) Dissolve the suspect foil in concentrated sulfuric acid and look for a rapid and intense color change of the solution.
(B) Conduct an organoleptic taste test to detect the distinct metallic bitterness associated

NODIA

with non-silver metals.
(C) Ignite the foil; pure silver foil crumbles into a grayish-black ash, while aluminum turns black but leaves a residue.
(D) Perform a high-intensity magnetic separation test to detect any trace presence of common ferromagnetic metal residues.

90. Which of the following is the most appropriate analytical technique for definitively identifying and quantifying Melamine adulteration in dairy products?
(A) Visual inspection and qualitative organoleptic testing of the milk's physical consistency.
(B) Standard Lactometer reading to determine specific gravity and total solids of the liquid sample.
(C) Simple acid-base titration using phenolphthalein indicator to measure natural lactic acidity levels.
(D) Liquid Chromatography coupled with tandem Mass Spectrometry (LC-MS/MS) for molecular confirmation.

91. Which specific chemical is frequently detected in the Baudouin test, indicating the adulteration of pure ghee or butter with Vanaspati?
(A) Furfural, which reacts with sesame oil (mandatorily added to Vanaspati) yielding a pink color.
(B) Formaldehyde, which forms a characteristic blue-violet complex with milk proteins upon acid addition.
(C) Diacetyl, which indicates the illegal addition of synthetic artificial flavoring agents to the ghee.
(D) Sanguinarine, which forms a distinct red precipitate under acidic conditions during laboratory testing.

92. Which of the following statements is correct regarding the adulteration of cereals and pulses?
(A) The deliberate addition of marble chips to raw rice is done to enhance the natural essential mineral profile of the grain.
(B) Kesari dal (Lathyrus sativus) is often used to adulterate arhar/toor dal and can cause the neurotoxic disease Lathyrism.
(C) Ergot fungal infestation in agricultural bajra is highly desirable because it increases the overall protein content.
(D) Surface polishing of raw rice with industrial talc is legally encouraged to prevent unwanted fungal growth during storage.

93. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): The use of artificial ripening agents like Calcium Carbide on fruits is strictly prohibited under standard food safety regulations.
Reason (R): Calcium Carbide naturally produces pure ethylene gas, which severely diminishes the nutritional value of the fruit without any other toxicological risks.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

94. Which of the following statements is incorrect regarding the detection of common food adulterants?
(A) The presence of Argemone oil in edible oils is confirmed by a simple iodine starch reaction resulting in a deep blue color.
(B) The presence of chalk powder in sugar can be detected by dissolving the sample in a glass of water, where the chalk will settle at the bottom.
(C) Water adulteration in milk can be indirectly assessed by checking the specific gravity using a lactometer.
(D) Metanil yellow in dal can be confirmed if the addition of hydrochloric acid turns the extraction solution magenta red.

95. During an inspection of a local spice mill, you notice bags of yellow colored powder labeled as "Industrial Dye - Not for Food Use" near the turmeric grinding area. Suspecting intentional adulteration, what specific chemical contaminant should the laboratory screen for?
(A) Tartrazine
(B) Rhodamine B
(C) Lead Chromate
(D) Malachite Green

96. Match List I with List II:
List I: (Simple Detection Method)
P. Rubbing the sample on palms; if color extracts, it implies adulteration.

Click Here to Buy book on Amazon

Q. Moving a magnet through the sample.
R. Dissolving in water; adulterant floats while pure item sinks.
S. Adding a few drops of Iodine solution.

List II: (Target Adulterant in Food)
I. Iron filings in Tea leaves
II. Sawdust in Coriander powder
III. Artificial color on green vegetables (Malachite green)
IV. Starch in Khoya/Mawa

Which of the following is the correct match?
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-IV, R-I, S-III

97. Which of the following is NOT typically used as an adulterant in edible cooking oils?
(A) Mineral oil
(B) Castor oil
(C) Monosodium glutamate (MSG)
(D) Argemone oil

98. Given below are two statements:
Statement I: The legal framework for controlling food adulteration in India is primarily governed by the Food Safety and Standards Act, 2006.
Statement II: The Food Safety and Standards Act, 2006 completely repealed and replaced the older Prevention of Food Adulteration (PFA) Act, 1954.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

99. Consider the following statements regarding the remediation and mitigation of heavy metals in the food chain:
1. Phytoextraction utilizes specific hyperaccumulator plants to remove heavy metals from contaminated agricultural soil.
2. Soil pH manipulation (e.g., adding lime) can reduce the bioavailability of certain heavy metals to crops.
3. Boiling contaminated vegetables completely vaporizes all heavy metals, rendering them safe.
4. Implementing strict industrial effluent treatment policies is a primary preventive remediation strategy.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

NODIA

100. Identify the correct pair connecting a common adulterant to its specific detection reagent.
(A) Hydrogen Peroxide in milk – Paraphenylenediamine test (turns blue)
(B) Formalin in milk – Resorcinol and Sulfuric Acid reaction (Kreis Test)
(C) Starch in milk – Specialized hot concentrated Nitric acid test
(D) Urea in milk – Standard potassium iodide and Iodine solution test

101. A consumer complaints platform receives multiple reports that a popular brand of green peas retains an unnaturally bright green color even after prolonged boiling. Which toxic adulterant is most likely being used to mask the age and quality of the peas?
(A) Metanil yellow
(B) Sudan III
(C) Malachite green
(D) Erythrosine

102. What is the cause-effect relationship defining "Epidemic Dropsy"?
(A) Consumption of mustard oil containing Argemone mexicana seed oil, which introduces sanguinarine, causing capillary leakage.
(B) Prolonged dietary consumption of Lathyrus sativus seeds causing a toxic accumulation of BOAA, leading to lower limb paralysis.
(C) Chronic ingestion of industrial lead chromate in spices causing acute enzymatic inhibition of heme synthesis and profound anemia.
(D) High dietary intake of secondary mycotoxins from moldy stored grains, directly causing acute liver failure and hepatic necrosis.

103. Identify the incorrect pair regarding regulatory food safety terminology.
(A) Sub-standard food – Food that does not meet specified quality standards but is not necessarily unsafe
(B) Unsafe food – Food whose nature, substance,

or quality is so affected as to render it injurious to health
(C) Misbranded food – Food offered or promoted for sale with false, misleading, or deceptive claims
(D) Extraneous matter – Intentional, high-toxicity synthetic chemicals added strictly for shelf-life extension

104. If a laboratory analysis of a suspected batch of synthetic milk confirms it contains water, vegetable fat, detergents, and urea, how should this product be classified under standard food safety laws?
(A) Sub-standard food
(B) Unsafe food
(C) Misbranded food
(D) Proprietary food

105. Arrange the following actions in the standard sequence followed by an authorized inspector upon suspecting food adulteration in a retail outlet:
1. Divide the sample into four representative parts and seal them appropriately.
2. Serve a formal notice to the Food Business Operator (FBO) indicating the intention to sample.
3. Send one sealed part to the Food Analyst for immediate testing.
4. Pay the cost of the sampled food to the FBO and obtain a receipt.

Which of the following is correct?
(A) 2, 4, 1, 3
(B) 1, 2, 4, 3
(C) 2, 1, 4, 3
(D) 4, 2, 1, 3

106. Which spice is commonly adulterated with exhausted (flavor-extracted) spices of the same type, making physical detection extremely difficult without chemical profiling?
(A) Saffron
(B) Mustard seeds
(C) Whole red chilies
(D) Clove

107. Which of the following statements is correct regarding the role of Consumer Awareness in combating food adulteration?
(A) Initiatives like rapid test kits (e.g., 'Detect Adulteration with Rapid Test') empower consumers to screen for common adulterants at home.
(B) Consumer awareness is irrelevant because regulatory bodies conduct daily laboratory testing of all food manufactured nationally.
(C) Consumers are legally prohibited from filing formal complaints about adulteration unless they possess a postgraduate food degree.
(D) Increased consumer awareness paradoxically leads to much higher rates of food adulteration by highly sophisticated retailers.

108. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): The detection of food fraud requires advanced analytical techniques like stable isotope ratio mass spectrometry (IRMS) or DNA barcoding.
Reason (R): Economically Motated Adulteration has become highly sophisticated, with adulterants chemically mimicking the natural parameters of the authentic food.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

109. Which of the following statements is incorrect regarding the distinction between Food Fraud and Accidental Contamination?
(A) Food Fraud is characterized by the deliberate intent to deceive the consumer for economic gain.
(B) The substitution of high-value Extra Virgin Olive Oil with cheaper soybean oil is an example of accidental contamination.
(C) Accidental contamination usually results from negligence, equipment failure, or environmental factors without intent to deceive.
(D) Diluting milk with contaminated water constitutes both food fraud (dilution) and a food safety hazard (contamination).

NODIA

110. A large food processing plant wants to reduce the levels of pesticide residues on incoming raw vegetables before canning. Which basic remediation step in the unit operations is most effective for removing contact (non-systemic) pesticides?

(A) High-pressure washing with potable water and peeling.
(B) Exposing the unwashed vegetables to ionizing radiation.
(C) Immediately freezing the unwashed vegetables to -18°C.
(D) Storing the vegetables in a modified atmosphere packaging for 7 days.

111. Match List I with List II:
List I: (Regulatory Entity / Provision)
P. Legal penalties for selling unsafe food
Q. Statutory powers of the Food Safety Officer
R. Food Safety Appellate Tribunal
S. Scientific Panels of a Food Authority
List II: (Function / Provision)
I. Actions taken by authorized enforcement officers
II. Punishment and fines for manufacturing or distributing unsafe food
III. Hearing appeals against decisions of the Adjudicating Officer
IV. Providing independent scientific advice and risk assessment
Which of the following is the correct match?
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-IV, R-III, S-I
(D) P-III, Q-I, R-II, S-IV

112. Which of the following is NOT an element typically targeted in a vulnerability assessment for Food Fraud (VACCP)?
(A) Historical incidence of fraud in the specific commodity
(B) Economic anomalies like sudden spikes in raw material prices
(C) Geopolitical stability of the supply chain source
(D) The specific heat capacity of the final packaged product

113. Given below are two statements:
Statement I: Rapid detection kits provided by food safety authorities are comprehensive analytical instruments capable of quantifying heavy metals down to parts-per-billion levels in schools.
Statement II: These rapid detection kits contain basic chemicals and apparatus designed to perform simple, qualitative tests for common adulterants to build consumer awareness.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

114. Consider the following strategies to reduce contaminant levels in food:
1. Implementing Good Agricultural Practices (GAP) to optimize pesticide use.
2. Using activated carbon filtration to remove toxins during the processing of liquid foods.
3. Implementing Hazard Analysis and Critical Control Points (HACCP) to monitor chemical hazards.
4. Increasing the legal Maximum Residue Limits to ensure no products fail the regulatory tests.

Which of the strategies given above are scientifically and legally appropriate?
(A) 1, 2, and 3
(B) 2, 3, and 4
(C) 1, 3, and 4
(D) 1, 2, and 4

115. Identify the correct pair representing a regulatory concept and its meaning.
(A) Recall – The commercial promotion of a new food product to target consumers immediately after a major safety alert.
(B) Adjudication – The corporate process of a food manufacturer self-certifying their product line as organic.
(C) Risk Assessment – The strictly political and legislative decision-making process used for banning regional imports.
(D) Traceability – The ability to track any food through all stages of production, processing, and distribution.

116. A local consumer rights group demonstrates that dropping a sample of silver-coated sweets into hydrochloric acid releases a gas with a strong garlic odor, while pure silver should not react this way. What toxic metal, often found in counterfeit silver foil, is responsible for this reaction?
(A) Antimony / Arsenic impurities
(B) Aluminum alloy residues
(C) Lead heavy metal particles

Downloaded from www.pdf.tube

(D) Cadmium mineral fragments

117. Which of the following cause-effect scenarios directly describes an intervention to prevent heavy metal contamination at the source?
(A) Prolonged boiling of raw milk for 20 minutes to completely eliminate dissolved elemental lead residues.
(B) Adding synthetic artificial coloring agents to successfully mask the dark spots caused by raw metal oxidation.
(C) Banning untreated industrial wastewater for agricultural irrigation to prevent Cadmium uptake in crops.
(D) Freezing harvested predatory fish at -40°C to completely destroy highly toxic methylmercury chemical compounds.

118. Identify the incorrect pair regarding consumer platforms and regulatory bodies.
(A) Food Safety Advisory Cell – National police force dedicated strictly to arresting food adulterators
(B) Central Food Authority – The primary apex food regulator establishing food standards
(C) Consumer Guidance Initiative – Platforms for national citizen guidance on safe and wholesome food
(D) Online Licensing System – Electronic portal used for licensing and registration of food business operators

119. When a farmer applies pesticides just one day before harvesting a tomato crop, despite the label mandating a 14-day Pre-Harvest Interval (PHI), what is the primary consequence?
(A) The harvested tomatoes will spoil almost instantly upon physical transport to local retail markets.
(B) The developing tomatoes will undergo immediate and spontaneous genetic mutation within the crop field.
(C) The applied pesticide will evaporate completely, rendering the agricultural application economically useless.
(D) The pesticide residues on harvested tomatoes will likely exceed the statutory Maximum Residue Limits (MRL).

120. What is the most appropriate long-term strategy for a national regulatory body to ensure compliance with pesticide MRLs?
(A) Implementing an immediate nationwide ban on the use and sale of all synthetic chemical pesticides in agriculture.
(B) Establishing robust monitoring, enforcing Good Agricultural Practices, and continuous farmer training.
(C) Relying entirely on individual consumers to wash their raw purchased food with highly concentrated detergents.
(D) Exclusively testing agricultural foods intended for export markets while completely ignoring domestic supplies.

NODIA

121. What is the standard scientific terminology for the process by which a contaminant's concentration increases in a biological organism over time, compared to the concentration in its environment?
(A) Biodegradation
(B) Biomagnification
(C) Bioaccumulation
(D) Bioremediation

122. Which of the following statements is correct regarding the application of the Pre-Harvest Interval (PHI)?
(A) PHI is the minimum amount of time an agricultural farmer must wait after sowing before applying chemical fertilizer.
(B) PHI applies exclusively and strictly to certified organic farming practices to maintain agricultural crop safety.
(C) A significantly longer PHI generally results in much higher toxic chemical residue levels on the harvested crop.
(D) Observing the recommended PHI ensures that pesticide residues degrade to levels at or below the legal MRL before harvest.

123. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): Endocrine-disrupting pesticides pose a unique regulatory challenge compared to acutely toxic pesticides.
Reason (R): Endocrine disruptors can exhibit non-monotonic dose-response curves, meaning low doses might cause significant effects that differ from high-dose toxicity.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.
(D) A is false but R is true.

124. Which of the following statements is incorrect concerning food fraud?
(A) It includes the misrepresentation of the geographic origin of a food product.
(B) It is synonymous with standard food spoilage caused by inadequate refrigeration.
(C) Adding unapproved chemical enhancers to mask poor quality is a form of food fraud.
(D) Counterfeiting a well-known food brand's packaging is considered food fraud.

125. A food processor intends to reduce the heavy metal load in locally sourced wheat. Which unit operation would be most effective in specifically reducing surface-level soil and metallic dust contaminants?
(A) Prolonged baking of the whole wheat grains at 250°C.
(B) Extensive dry milling and separation of the bran layer.
(C) Fermentation of the whole wheat for 48 hours.
(D) Fortification of the wheat flour with elemental iron.

126. Match List I with List II:
List I: (Adulteration Detection Test)
P. Iodine Test (for starch)
Q. Baudouin Test (for Vanaspati in ghee)
R. Nitric Acid Test (for argemone oil in edible oil)
S. Hydrochloric Acid Test (for metanil yellow in dal)
List II: (Observation for Positive Result)
I. Appearance of a crimson / pink color in the acid layer
II. Appearance of a deep magenta / red color
III. Appearance of a red-brown to reddish color in the acid layer
IV. Appearance of a deep blue color
Which of the following is the correct match?
(A) P-IV, Q-I, R-III, S-II
(B) P-I, Q-II, R-IV, S-III
(C) P-IV, Q-III, R-I, S-II
(D) P-II, Q-IV, R-III, S-I

127. Which of the following is NOT a fundamental component of a comprehensive risk assessment framework for food contaminants?
(A) Hazard Identification
(B) Hazard Characterization
(C) Economic Profitability Assessment
(D) Exposure Assessment

128. Given below are two statements:
Statement I: The apex food regulatory authority in India operates under the administrative control of the Ministry of Agriculture and Farmers Welfare.
Statement II: The apex food regulatory authority is responsible for laying down science-based standards for articles of food and regulating their manufacture, storage, distribution, sale, and import.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

129. Consider the following actions taken to prevent accidental heavy metal contamination in processed foods:
1. Using food-grade stainless steel for processing equipment.
2. Sourcing raw materials from regions far from industrial effluent discharge.
3. Completely eliminating water from all food formulations.
4. Implementing regular calibration and maintenance of processing machinery to prevent metal shedding.
Which of the actions given above are practical and effective?
(A) 1, 2, and 3
(B) 1, 2, and 4
(C) 2, 3, and 4
(D) 1, 3, and 4

130. Identify the correct pair associating a mitigation strategy with its primary target contaminant.
(A) Use of pheromone traps in agricultural fields – Effective reduction of systemic crop heavy metal absorption.
(B) Implementation of Integrated Pest Management (IPM) – Reduction of reliance on chemical pesticides.
(C) Flash pasteurization of raw milk – Complete thermal destruction of highly toxic chemical

Click Here to Buy book on Amazon

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

pesticide residues.
(D) Addition of Vitamin D to whole milk – Complete precipitation and removal of melamine chemical adulterants.

131. When a honey packaging facility routinely blends pure honey with high fructose corn syrup (HFCS) to lower costs while labeling the product "100% Pure Organic Honey," this practice directly violates provisions against:
(A) Deliberate occurrence of accidental raw cross-contamination.
(B) Unauthorized use of unapproved hazardous heavy metals.
(C) Direct violation of established Maximum Residue Limits.
(D) Economically Motated Adulteration and Misbranding.

132. How does the implementation of a rigorous traceability system mitigate the public health impact of a widespread pesticide contamination event?
(A) It allows rapid identification, isolation, and targeted recall of contaminated batches from the supply chain.
(B) It directly neutralizes the active chemical toxicity of systemic pesticide residues inside the food matrix.
(C) It automatically calculates and applies a massive legal monetary fine directly to the responsible crop farmer.
(D) It actively prevents the applied pesticide spray from initially binding to the delicate surface crop foliage.

133. Identify the incorrect pair regarding food safety violations and their corresponding regulatory penalty provisions.
(A) Penalty for selling food not of the nature or substance or quality demanded – Financial penalty
(B) Penalty for sub-standard food – Financial penalty
(C) Penalty for manufacturing food without an ISO 9001 certification – Imprisonment
(D) Penalty for misbranded food – Financial penalty

134. When training agricultural workers to minimize their occupational exposure to organophosphate pesticides, which topic is of the highest priority for immediate health and safety?
(A) The proper selection, use, and decontamination of Personal Protective Equipment (PPE).
(B) The comprehensive economic cost-benefit analysis of organic versus conventional farming methods.
(C) The detailed history and development of chemical pesticide usage throughout the 20th century.
(D) The complex biochemical synthesis pathway of active malathion formulations in a laboratory.

135. Arrange the general steps of a quantitative risk assessment for a new chemical food contaminant in the correct order:
1. Risk Characterization (comparing exposure to the hazard threshold)
2. Exposure Assessment (estimating dietary intake levels)
3. Hazard Identification (identifying potential adverse health effects)
4. Hazard Characterization (establishing dose-response relationship, e.g., NOAEL)

Which of the following is correct?
(A) 3, 4, 2, 1
(B) 1, 2, 3, 4
(C) 3, 2, 4, 1
(D) 4, 3, 2, 1

136. What does the acronym "DART" stand for in the context of rapid testing initiatives for food safety?
(A) Dietary Allowance and Regulatory Testing
(B) Detect Adulteration with Rapid Test
(C) Department of Agricultural Residue Tolerance
(D) Daily Assessment of Residual Toxicity

137. Which of the following statements is correct regarding the role of food safety inspectors in consumer protection?
(A) They are legally authorized to arrest and jail ordinary retail consumers who unknowingly purchase sub-standard food.
(B) They are strictly limited to inspecting administrative documents and cannot physically draw samples of suspicious food.
(C) They are empowered to sample food from any food business operator and send them to an analyst to verify safety compliance.
(D) Their primary administrative duty is to dictate and enforce the market pricing of

NODIA

essential agricultural commodities.

138. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R):
Assertion (A): Risk communication is a continuous, interactive exchange of information and opinions among risk assessors, risk managers, consumers, and other stakeholders.
Reason (R): Transparent risk communication prevents public panic and ensures consumers can make informed choices regarding food contaminants.
Which of the following is correct?
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

139. Which of the following statements is incorrect regarding public consumer education portals managed by food safety authorities?
(A) They serve as the primary legal platform where inspectors upload confidential prosecution records.
(B) They actively aim to design and implement programs to create a nationwide culture of safe, nutritious, and wholesome food.
(C) They provide robust, actionable, and scientific guidance specifically tailored for home, school, workplace, and dining.
(D) They act as primary educational hubs and interactive centers to build consumer awareness regarding safe food handling.

140. A consumer finds a dead insect inside a sealed bottle of a popular beverage. Under which specific category does this hazard fall, and what is the consumer's most appropriate initial step?
(A) Biological Contaminant; Immediately consume the entirety of the beverage product and report clinical symptoms to police.
(B) Physical Matter; Retain the sealed bottle, note batch details, and register a complaint on the official regulatory grievance portal.
(C) Chemical Contaminant; Package the sample carefully and ship it directly to the World Health Organization headquarters.
(D) Intentional Adulteration; Dispose of the suspect beverage bottle secretly in household waste to avoid future legal trouble.

141. Match List I with List II:
List I: (Regulatory/Scientific Entity)
P. National Food Authority
Q. National Laboratory Accreditation Board
R. Codex Alimentarius Commission
S. Joint FAO/WHO Expert Committee on Food Additives (JECFA)
List II: (Role in Food Safety)
I. International body that evaluates the safety of food additives and contaminants.
II. Apex regulatory body establishing science-based food standards at the national level.
III. Board responsible for the accreditation of testing and calibration laboratories.
IV. International commission established by FAO and WHO to develop international food standards.
Which of the following is the correct match?
(A) P-II, Q-III, R-IV, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-IV, R-III, S-I
(D) P-III, Q-I, R-IV, S-II

142. Which of the following is NOT a core mandate of a national food safety authority?
(A) Setting the Maximum Retail Price (MRP) for agricultural commodities.
(B) Framing of regulations to lay down food safety standards.
(C) Granting licenses and registration to Food Business Operators.
(D) Creating an information network for rapid dissemination of food safety alerts.

143. Given below are two statements:
Statement I: The standards set by the Codex Alimentarius Commission are legally binding treaties that all United Nations member countries must adopt exactly as written.
Statement II: National food safety authorities frequently harmonize domestic food standards with Codex standards to facilitate international trade while considering regional dietary patterns.
Which of the following is correct?
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

Downloaded from www.pdf.tube

144. Consider the following mechanisms designed for consumer protection against food contaminants:
1. Mandatory nutritional and allergen labeling on packaged foods.
2. Establishment of Food Safety Appellate Tribunals for speedy disposal of cases.
3. Online regulatory portals or mobile applications for citizens to report violations.
4. Mandatory quarterly blood testing of all consumers by the state health department.

Which of the mechanisms given above are actually implemented under standard food safety frameworks?
(A) 1, 2, and 3
(B) 2, 3, and 4
(C) 1, 3, and 4
(D) 1, 2, and 4

145. Identify the correct pair regarding elements of the food safety legal framework.
(A) Food Analyst – A designated regulatory officer who inspects and audits major food manufacturing premises.
(B) Food Business Operator (FBO) – An individual retail consumer who purchases packaged food from local stores.
(C) Designated Officer (DO) – The authority who issues or cancels FBO licenses in a specific district.
(D) Adjudicating Officer – A laboratory scientist who conducts pesticide residue analysis on food samples.

146. Widespread media reports claim that a local municipality's drinking water supply is heavily contaminated with agricultural pesticides, causing public panic. As part of risk communication, what is the best immediate step for the regulatory authority?
(A) Ignore the public reports completely until a comprehensive, nationwide 5-year longitudinal scientific study is fully completed.
(B) Conduct rapid sampling, analyze against standards, and transparently release verified data and advisories to the public.
(C) Immediately shut down the entire municipal water supply system permanently without performing any laboratory chemical testing.
(D) Arrest the reporting journalists under national security acts to immediately stop the dissemination of public panic.

NODIA

147. What is the desired cause-effect outcome of strictly enforcing punitive measures against Economically Motated Adulteration?
(A) To artificially elevate the retail market cost of essential food products exponentially for low-income consumers.
(B) To systematically force all small-scale, traditional food vendors and independent farmers out of business permanently.
(C) To actively promote and encourage the black market trading and illegal hoarding of essential consumer food commodities.
(D) To deter fraudulent practices by making the financial and legal risks far outweigh potential illegal profits, protecting the food supply.

148. Identify the incorrect pair regarding regulatory enforcement authorities and their functions.
(A) Agricultural Extension Officer – Holds exclusive legal power to penalize food adulterators in court.
(B) Food Safety Inspector – Draws representative food samples and physically inspects food processing units.
(C) Food Analyst – Receives and analyzes the suspect sample, subsequently issuing a conclusive scientific report.
(D) Commissioner of Food Safety – Heads the entire administrative food safety and enforcement department at the state level.

149. You are tasked with organizing a consumer awareness drive on food safety in a rural district. Which of the following is the most practical and effective competency-based activity to include?
(A) Lecturing rural citizens on the complex, highly specific molecular structures of various organochlorine pesticides.
(B) Distributing exhaustive, printed copies of national food acts to every rural household.
(C) Demonstrating simple rapid tests from the consumer safety manuals to detect common adulterants like starch and chalk.
(D) Teaching consumers how to technically operate complex High-Performance Liquid Chromatography machines.

150. What is the ultimate, overarching goal of regulating food contaminants, heavy metals, pesticides, and adulterants through food safety legislation?
(A) To ensure the availability of safe and

wholesome food for human consumption and protect public health.

(B) To generate continuous financial revenue for municipal governments through the licensing fees and fines.

(C) To completely eliminate and ban all organic chemicals, natural or synthetic, from the daily human diet.

(D) To strictly limit the export of premium agricultural food products to protect domestic trading monopolies.

www.nodia.in

Click Here to Buy book on Amazon

ANSWERS

1. (C) Any biological, chemical, or physical substance not intentionally added to food that compromises safety or suitability.
Food contaminants represent any biological, chemical, or physical agents present in food unintentionally, arising from environmental exposure, processing, packaging, transport, or storage. These foreign elements can compromise the overall safety, wholesomeness, or suitability of food products, posing potential health hazards to consumers. Standard regulatory guidelines distinguish these accidental substances from intentionally added food ingredients or approved additives.

2. (B) Anthropogenic activities such as mining, industrial emissions, and agrochemical usage contribute significantly to soil contamination.
Heavy metals enter the food chain primarily through environmental contamination driven by human activities. Anthropogenic processes, including mining operations, industrial waste discharges, fossil fuel combustion, and the extensive application of agricultural chemical fertilizers or pesticides, release significant quantities of these persistent elements into the soil and water. Once in the agricultural ecosystem, crops absorb and accumulate these toxic metals.

3. (C) A is true but R is false.
Chronic ingestion of groundwater contaminated with inorganic arsenic represents a major global public health crisis, particularly in geological zones like the Bengal basin. Inorganic arsenic is highly toxic and does not undergo rapid biodegradation in human tissues; instead, it accumulates progressively, leading to severe chronic systemic toxicity, multi-organ damage, and various forms of cancer over time.

4. (A) Intentional food adulterants like brick powder in chili powder are technically classified as incidental contaminants.
Food safety frameworks categorize contaminants based on their origin and nature. Intentional food adulteration involves the deliberate addition of foreign materials, such as brick powder in chili powder, to increase economic profit. This differs fundamentally from incidental contamination, which refers to the accidental, non-deliberate entry of environmental, physical, or chemical substances into food products during processing or handling.

5. (C) Quantifying the ratio of toxic inorganic arsenic species to the relatively benign organic arsenic compounds.
Determining human health risks from arsenic exposure requires chemical speciation to distinguish between different molecular forms. Inorganic arsenic species, such as arsenite and arsenate, are highly toxic and carcinogenic to humans. Conversely, organic arsenic compounds, commonly found in marine organisms, are significantly less toxic and generally excreted rapidly by the human body without causing major systemic harm.

6. (A) P-III, Q-IV, R-I, S-II
Environmental and chemical food contaminants belong to distinct functional categories. Cadmium is a toxic heavy metal that accumulates in renal tissues. Dieldrin represents a highly persistent organochlorine pesticide banned globally. Metanil yellow is an unapproved, hazardous synthetic dye used illegally as an adulterant. Bisphenol A is an industrial chemical that acts as a potent endocrine disruptor.

7. (D) Biodegradation of complex carbohydrate polymers in soil organic matter.
Arsenic contamination in the agricultural food chain originates from both natural geological formations and human activities. Common pathways include using arsenic-laden groundwater for crop irrigation, historical applications of arsenical pesticides, and natural processes like volcanic eruptions. The metabolic breakdown of soil organic matter, such as complex carbohydrates by microorganisms, does not generate, release, or synthesize elemental arsenic.

8. (A) Both Statement I and Statement II are correct.
Inorganic arsenic exerts its cellular toxicity through specific biochemical interactions. The toxicant binds with high affinity to the sulfhydryl groups of key cellular enzymes, leading to their

Downloaded from www.pdf.tube

inactivation. This biochemical interference directly disrupts the citric acid cycle, uncouples mitochondrial oxidative phosphorylation, and impairs cellular respiration, ultimately halting the vital production of cellular adenosine triphosphate.

9. (B) 2, 3, and 4
Chronic exposure to inorganic arsenic yields distinctive systemic pathological effects over long periods. Key clinical manifestations include hyperkeratosis on the palms and soles, hyperpigmentation, and an elevated risk of skin, lung, and bladder cancers. It also induces severe peripheral vascular disease, historically termed Blackfoot disease, whereas acute paralysis is not a typical characteristic of chronic low-dose toxicity.

10. (D) Arsenite (As III) – Highly toxic inorganic form
The toxicity of arsenic depends heavily on its chemical state and valency. Inorganic forms are significantly more hazardous than organic species. Among inorganic arsenic, arsenite, which is the trivalent state, is highly toxic and possesses a greater affinity for cellular enzymes than the pentavalent arsenate. Arsenobetaine and arsenosugars represent organic forms that exhibit extremely low toxicity.

11. (A) Arsenic
Chronic consumption of groundwater from contaminated tube wells leads to arsenicosis. This systemic condition is characterized by specific dermal lesions, including hyperpigmentation and hyperkeratosis on the palms of the hands and soles of the feet. It also causes severe damage to peripheral blood vessels, leading to gangrene, a condition historically documented in affected rural populations.

12. (B) Inhibition of the pyruvate dehydrogenase complex.
Arsenic disrupts cellular respiration primarily by binding to the lipoic acid cofactor within the pyruvate dehydrogenase complex. This specific chemical inhibition prevents the conversion of pyruvate to acetyl-coenzyme A, effectively halting the flow of substrates into the tricarboxylic acid cycle. Consequently, mitochondrial energy production is severely impaired, leading to cellular starvation and eventual cell death.

NODIA

13. (B) Arsenic – Improper disposal of polyvinyl chloride (PVC) plastics
Heavy metals originate from distinct industrial processes. Lead contamination is historically linked to leaded gasoline and older paint formulations, while cadmium is associated with phosphate fertilizers and battery disposal. Mercury enters ecosystems via chlor-alkali plants and mining. However, arsenic is not a constituent or degradation product of polyvinyl chloride plastics, which typically release plasticizers and chlorine compounds.

14. (A) Arsenic, Lead, and Mercury
Coal-fired power plants emit fly ash, which contains concentrated levels of highly toxic environmental contaminants. The primary heavy metals of critical public health concern found in these industrial emissions include arsenic, lead, and mercury. These elements deposit onto agricultural soils and can be readily absorbed by crops, necessitating targeted laboratory monitoring to ensure food safety in surrounding areas.

15. (A) 3, 1, 4, 2
The transfer of persistent contaminants up aquatic food chains follows a progressive trophic sequence. The process begins when primary producers like phytoplankton absorb dissolved metals from water. Zooplankton then ingest these producers, accumulating the toxins. Small planktivorous fish consume the zooplankton, concentrating the contaminants further. Finally, apex predators, such as fish-eating birds, ingest the prey, experiencing maximum biomagnification.

16. (D) Itai-Itai disease
Itai-Itai disease is a painful chronic condition caused by long-term environmental exposure to cadmium, historically occurring in Japan due to contaminated river water. The toxicant causes severe renal tubular dysfunction, preventing the reabsorption of essential minerals. This leads to profound calcium loss from bones, causing osteomalacia, multiple skeletal fractures, and intense systemic bone pain.

17. (C) Cadmium accumulates primarily in the liver and kidneys, exhibiting a biological half-life of 10 to 30 years.
Cadmium exhibits highly persistent toxicokinetics within the human body. Once absorbed, it binds to the protein metallothionein and accumulates

predominantly in the liver and the renal cortex. Due to the lack of an active, efficient physiological excretion pathway, cadmium is retained in these organs for decades, possessing an exceptionally long biological half-life of ten to thirty years.

18. (A) Both A and R are true and R is the correct explanation of A.
Lead exposure poses a disproportionately high risk to infants and young children. Physiologically, children absorb a significantly larger percentage of ingested lead through their gastrointestinal tract compared to adults. Furthermore, their developing blood-brain barrier is more permeable, and their rapidly growing central nervous system is highly sensitive to lead-induced neurotoxicity, resulting in irreversible cognitive deficits and developmental delays.

19. (D) The body readily metabolizes absorbed elemental lead into harmless organic compounds that are quickly exhaled through the lungs.
Lead is a highly toxic, non-essential elemental metal that the human body cannot metabolize or degrade into harmless substances. Once absorbed, lead mimics calcium and distributes to soft tissues and bones, where it remains stored for years. It is excreted very slowly through urine and feces, and cannot be eliminated through pulmonary respiration or exhalation.

20. (A) Test the cooked food and ceramic leaching for Lead using standard acidic extraction methods.
Traditional brightly colored ceramic glazes often contain lead compounds used to stabilize pigments. When acidic foods are cooked or stored in these vessels, the lead can leach out into the food matrix. Standard regulatory testing protocols utilize acidic solutions, such as acetic acid, to simulate cooking conditions and measure the quantity of lead released from the cookware.

21. (A) P-II, Q-I, R-IV, S-III
Heavy metals target specific physiological systems in the human body. Lead primarily affects the central nervous system, causing cognitive and neurological deficits. Cadmium damages the renal cortex and bones, leading to osteomalacia. Methylmercury is a potent neurotoxin responsible for Minamata disease. Inorganic arsenic targets the skin, causing keratosis, and damages the cardiovascular system over long periods.

22. (A) Ingestion of deep-sea pelagic fish containing high levels of methylmercury.
Humans are exposed to cadmium through specific environmental and dietary pathways. These include the consumption of marine bivalves and crustaceans that naturally concentrate the metal, inhalation of tobacco smoke, and ingestion of crops grown in soils treated with cadmium-rich phosphate fertilizers. Ingesting deep-sea fish containing methylmercury represents a major exposure route for mercury, not cadmium.

23. (A) Both Statement I and Statement II are correct.
Inorganic mercury released into aquatic systems undergoes biological transformation by anaerobic bacteria, converting it into highly toxic methylmercury. This organic chemical form is highly lipophilic and stable, allowing it to easily penetrate biological membranes. Consequently, it bioaccumulates within aquatic organisms and biomagnifies progressively up the food chain, reaching peak concentrations in top predatory fish.

24. (B) 2, 3, and 4
Minamata disease is a severe, chronic neurological syndrome caused by methylmercury poisoning, first identified in Japan following industrial wastewater discharges. The disease manifests as sensory loss, ataxia, muscle weakness, and speech impairments. It can also cross the placental barrier, leading to congenital manifestations and developmental damage in the fetus, whereas lead is not the causative agent.

25. (C) Lead – Blood lead levels (BLL) and erythrocyte protoporphyrin
Clinical assessment of heavy metal exposure relies on validated physiological biomarkers. Blood lead level is the gold-standard biomarker used to evaluate recent and ongoing lead exposure, often supported by measuring erythrocyte protoporphyrin, which reflects lead-induced disruption of heme synthesis. Measuring these specific biological parameters provides reliable, quantifiable data necessary for medical and regulatory interventions.

26. (D) Methylmercury
Large, long-lived predatory marine fish like shark and swordfish occupy high trophic levels and accumulate significant levels of methylmercury. Chronic dietary intake of these species can

Click Here to Buy book on Amazon

cause neurological damage. Clinical symptoms of this toxicity include sensory impairment, such as numbness, ataxia, and constriction of visual fields, reflecting the neurotoxic profile of organic mercury.

27. (A) Low molecular weight proteinuria, specifically increased excretion of beta-2-microglobulin.
Cadmium preferentially accumulates in the proximal tubules of the renal cortex. This chronic accumulation causes progressive cellular damage, impairing the tubules' ability to reabsorb filtered proteins. Consequently, individuals exhibit low molecular weight proteinuria, characterized by elevated urinary excretion of specific proteins such as beta-2-microglobulin, which serves as a sensitive clinical biomarker for cadmium-induced nephrotoxicity.

28. (B) Hexavalent Chromium – Acting as a potent neurotoxin by blocking cellular acetylcholine receptors
Heavy metals exert toxicity through specific, distinct pathways. Lead inhibits enzymes involved in heme synthesis, methylmercury binds sulfhydryl groups in nervous tissue, and cadmium mimics calcium and zinc. Hexavalent chromium, however, does not act primarily as a neurotoxin blocking acetylcholine receptors; instead, it is a potent intracellular oxidizing agent, causing DNA damage, mutagenicity, and carcinogenicity.

29. (B) Limit large predatory fish due to methylmercury biomagnification, choosing smaller, lower-trophic fish.
Pregnant women must manage their dietary intake of fish to minimize fetal exposure to neurotoxins. Large predatory fish accumulate high concentrations of methylmercury through biomagnification. To reduce risk while obtaining essential omega-three fatty acids, guidelines recommend limiting these high-trophic species and instead selecting smaller, low-trophic fish, which contain significantly lower levels of organic mercury.

30. (A) Analysis of lead content in bone tissues using X-ray fluorescence.
In the human body, absorbed lead is stored long-term in mineralized tissues, substituting for calcium. While blood lead levels reflect recent exposure, evaluating chronic, lifetime cumulative exposure requires measuring lead stored in bones. Non-invasive X-ray fluorescence of bone tissue provides the most reliable and accurate measure of these long-term skeletal lead deposits.

NODIA

31. (C) Chromium (VI)
Chromium exists in multiple oxidation states with vastly different toxicological profiles. Hexavalent chromium is highly toxic, mutagenic, and carcinogenic. Because of its structural similarity to sulfate ions, it easily crosses cellular membranes via active transport mechanisms. Once inside the cell, it undergoes reduction, generating highly reactive oxygen species and causing direct damage to cellular DNA.

32. (D) Permissible limits are established based on the food matrix, toxicological data, and standard dietary exposure assessments.
Food safety authorities establish legally enforceable permissible limits for heavy metals in food. These regulations do not use a blanket zero-tolerance approach; instead, they are formulated using scientific risk assessments. Limits are tailored to specific food matrices, toxicological thresholds derived from animal studies, and comprehensive exposure assessments based on national dietary consumption patterns.

33. (A) Both A and R are true and R is the correct explanation of A.
Hydrophobic, persistent organic pollutants like organochlorines exhibit high biomagnification potential within ecological food webs. Because these chemical substances are highly lipophilic, they accumulate within the fatty tissues of living organisms. They resist metabolic degradation and physical excretion, resulting in progressively higher concentrations in animal tissues at successively higher trophic levels of the food chain.

34. (B) International guidelines legally override all national food safety laws automatically upon publication.
International organizations establish global standards for food safety, such as maximum levels for contaminants. While these standards serve as scientific benchmarks for international trade and resolving disputes under the World Trade Organization, they do not automatically override national laws. Each sovereign nation must formally adopt, adapt, or legislate these guidelines into their own domestic regulatory frameworks.

35. (D) Biomagnification
The progressive increase in the concentration of a persistent chemical contaminant from water through plankton, small fish, and up to apex predatory birds demonstrates biomagnification. This ecological phenomenon occurs when a stable, lipophilic substance is absorbed by lower-trophic organisms and transferred through ingestion, becoming highly concentrated in the tissues of predators at the top of the food chain.

36. (A) P-III, Q-IV, R-I, S-II
Regulatory and scientific concepts have precise definitions. Bioaccumulation describes the gradual build-up of a chemical within an individual organism over time. Biomagnification refers to increasing toxin concentrations up successive trophic levels. The Maximum Residue Limit is the highest legally permitted pesticide residue on food. Tolerable Daily Intake estimates safe daily exposure over a lifetime.

37. (C) High water solubility (hydrophilicity)
Biomagnification is driven by specific chemical properties of a contaminant. Key factors that promote this process include high lipid solubility, which allows storage in fat, resistance to chemical or enzymatic degradation, and a slow rate of excretion. Conversely, high water solubility prevents biomagnification because hydrophilic substances are easily metabolized and excreted from the body in urine.

38. (A) Both Statement I and Statement II are correct.
Trivalent chromium is an essential dietary trace element that plays a vital role in human carbohydrate, lipid, and glucose metabolism. Dietary intake of this nutrient can be enhanced during food preparation; cooking acidic foods in stainless steel pots and pans causes the minor, safe leaching of trivalent chromium from the alloy into the food matrix.

39. (A) 1, 2, and 4
National food safety frameworks legally mandate permissible limits for heavy metals. To protect highly vulnerable populations, the allowable limits for lead in infant formulas are set much lower than those for adult foods. Export and import certifications require mandatory laboratory analysis, and naturally occurring elevated levels do not exempt products from safety enforcement actions.

40. (B) Bioconcentration – Uptake of contaminants exclusively from surrounding water, completely independent of dietary food.
Environmental toxicology distinguishes between different chemical uptake pathways. Bioconcentration refers specifically to the absorption of a contaminant by an aquatic organism directly from the surrounding water through respiratory or dermal surfaces, excluding dietary sources. This differs from bioaccumulation, which includes all exposure routes, and biomagnification, which occurs strictly through successive trophic food consumption.

41. (C) Bioaccumulation in oysters without significant biomagnification in the tissues of the consuming birds.
When an aquatic organism concentrates a heavy metal like cadmium from water containing very low levels, it undergoes bioaccumulation. If the consuming predators at a higher trophic level do not exhibit increased concentrations of the metal, biomagnification is not occurring. This indicates that while the metal accumulates individually, it does not magnify through the food chain.

42. (D) They possess high lipophilicity and resist enzymatic degradation, storing extensively in physiological adipose tissue.
Organochlorine pesticides possess unique chemical properties that drive their high bioaccumulation potential. These synthetic compounds are highly lipophilic, meaning they dissolve readily in fats rather than water. Because they resist natural chemical and enzymatic degradation pathways, they cannot be easily broken down or excreted, resulting in long-term storage and concentration within animal adipose tissues.

43. (A) MRL – Minimum Required Limit, the lowest amount of nutrient that must be present in food
Food safety standards use precise regulatory terminology to manage chemical hazards. The acronym MRL stands for Maximum Residue Limit, representing the highest concentration of pesticide residue legally permitted on food, not a minimum nutrient requirement. Acceptable Daily Intake, Provisional Tolerable Weekly Intake, and the ALARA principle are correctly defined and used in contaminant management.

Downloaded from www.pdf.tube

44. (B) Reject the batch and initiate recall or enforcement action for exceeding the statutory permissible limit.
Permissible limits established by food safety regulations are legally binding safety thresholds. When a batch of packaged drinking water is found to contain lead concentrations exceeding the statutory limit of 0.01 milligrams per liter, the product is classified as unsafe. The regulatory authority must reject the batch and initiate a product recall or enforcement action.

45. (B) 1, 2, 3, 4
Setting a pesticide Maximum Residue Limit follows a structured scientific sequence. First, toxicological evaluations establish the Acceptable Daily Intake. Next, supervised agricultural field trials determine the actual residue levels under Good Agricultural Practices. Analysts then perform a risk characterization by comparing estimated dietary intake with the safety threshold. Finally, the regulatory limit is proposed and legally adopted.

46. (A) Herbicides
Pesticides are chemicals formulated to manage specific target pests in agricultural and urban environments. While insecticides target damaging insects, fungicides control mold pathogens, and nematicides manage microscopic worms, herbicides are specifically designed to suppress, inhibit, or destroy competitive, unwanted weed growth that interferes with the yield and health of agricultural crops.

47. (C) Pyrethroids are synthetic derivatives of naturally occurring botanical compounds found in chrysanthemum flowers.
Pesticides are classified chemically into distinct groups. Pyrethroids are synthetic insecticides structurally modeled after pyrethrins, which are natural insecticidal compounds extracted from chrysanthemum flowers. Unlike organochlorines, which are highly persistent, and organophosphates, which act by inhibiting acetylcholinesterase, pyrethroids target sodium channels in insect nerve membranes and degrade relatively quickly in the environment.

48. (A) Both A and R are true and R is the correct explanation of A.
Organochlorine pesticides, such as dichlorodiphenyltrichloroethane, are strictly regulated or banned globally under the Stockholm Convention on Persistent Organic Pollutants. These chemical substances possess high environmental stability, resisting natural physical and biological degradation. Consequently, they persist in ecosystems for decades, accumulate in adipose tissues, biomagnify up food chains, and present severe chronic toxicity risks.

49. (C) All fungicides act exclusively by disrupting the nervous system of the fungal pathogen.
Fungicides are chemical compounds applied to suppress fungal diseases in crops, which indirectly helps minimize the production of toxic mycotoxins. Unlike insecticides, which frequently target nervous systems, fungi lack a nervous system. Fungicides act by diverse mechanisms, including disrupting cell membrane synthesis, interfering with cellular respiration, or inhibiting cell division, with some acting systemically within plants.

NODIA

50. (B) Irreversible inhibition of acetylcholinesterase, leading to systemic acetylcholine accumulation.
Organophosphate pesticides exert their acute toxicity through a specific neurological mechanism. These compounds bind to and inhibit the enzyme acetylcholinesterase at nerve synapses. This biochemical inhibition prevents the normal breakdown of the neurotransmitter acetylcholine, leading to its rapid accumulation, continuous stimulation of the nervous system, and the development of severe cholinergic symptoms.

51. (A) P-IV, Q-III, R-I, S-II
Pesticides belong to diverse chemical classes with unique active ingredients. Endosulfan is a persistent organochlorine insecticide. Malathion is a widely used organophosphate that inhibits acetylcholinesterase. Aldicarb represents a highly toxic carbamate insecticide. The compound 2,4-dichlorophenoxyacetic acid is a common phenoxy herbicide used to control broadleaf weeds in agricultural fields.

52. (A) Low lipid solubility resulting in rapid excretion in urine
Organochlorine pesticides are characterized by specific, highly stable chemical structures. They possess extremely low water solubility and high lipid solubility, which prevents rapid renal excretion and causes them to store in body fat. Their high resistance to biological degradation and potential for endocrine disruption have led to global regulatory bans and phase-outs.

53. (A) Both Statement I and Statement II are correct.
Organophosphate pesticides exhibit different environmental and toxicological properties than organochlorines. They degrade much faster in the environment through hydrolysis and photolysis, which significantly reduces their potential for long-term bioaccumulation. However, organophosphates generally possess much higher acute toxicity to mammals, presenting a severe risk of acute chemical poisoning to agricultural workers during handling.

54. (B) 2 and 3
Maximum Residue Limits are regulatory trade standards, not absolute toxicological safety limits. They represent the highest pesticide residue concentration expected when a chemical is applied in compliance with Good Agricultural Practices. Exceeding an MRL indicates an agricultural misuse or violation of guidelines, but does not automatically mean the food poses an immediate acute health risk.

55. (D) Insecticides – Selective disruption of the nervous system or cuticle formation in target insects.
Pesticides are formulated to target specific biological processes in pest organisms. Insecticides are designed to disrupt the nervous system, interfere with neurotransmission, or inhibit cuticle formation in target insects. Herbicides target plant-specific pathways like photosynthesis, fungicides inhibit fungal cell wall or membrane synthesis, and rodenticides often interfere with blood coagulation mechanisms.

56. (B) Organophosphates
The clinical presentation of pinpoint pupils, excessive salivation, muscle fasciculations, and respiratory distress defines the cholinergic toxidrome. This condition is caused by the overstimulation of the nervous system due to acetylcholinesterase inhibition. This specific toxicity profile is highly characteristic of acute exposure to organophosphate or carbamate pesticides, which are common in agricultural operations.

57. (C) DDE (a metabolite of DDT) caused the thinning of eggshells by inhibiting calcium ATPase in the shell gland.
The historical decline in predatory bird populations from DDT exposure was caused by reproductive failure. The persistent metabolite dichlorodiphenyldichloroethylene accumulates in the tissues of female birds and inhibits the enzyme calcium adenosine triphosphatase in the shell gland. This biochemical disruption impairs calcium deposition, producing thin-shelled eggs that break easily during nesting.

58. (D) Thin Layer Chromatography (TLC) – The highly sensitive, modern gold-standard for quantifying pesticide residues at trace levels.
Pesticide residue analysis relies on advanced, highly sensitive analytical instrumentation. While gas chromatography and liquid chromatography coupled with mass spectrometry are the modern gold standards for separating, identifying, and quantifying trace contaminants, thin-layer chromatography is a basic, qualitative technique that lacks the sensitivity and resolution required for modern trace-level regulatory compliance.

59. (A) The No Observed Adverse Effect Level (NOAEL) in chronic animal toxicity studies.
Calculating the Acceptable Daily Intake for a chemical contaminant requires establishing toxicological thresholds. The primary parameter used is the No Observed Adverse Effect Level, determined through long-term, chronic animal toxicity studies. Applying uncertainty factors to this value accounts for interspecies and intraspecies variation, yielding a safe daily intake level for human populations.

60. (B) QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe)
Modern food testing laboratories require rapid, efficient sample preparation methods. The QuEChERS methodology represents the industry standard for multi-residue pesticide extraction from diverse food matrices. This technique significantly reduces the volume of hazardous organic solvents, simplifies extraction steps, and provides high recovery rates, replacing older, labor-intensive extraction methods like Soxhlet extraction.

61. (B) The maximum concentration of a pesticide residue legally permitted in or on food and agricultural commodities.
The Maximum Residue Limit is a legally binding standard established by food safety regulators. It defines the maximum concentration of a specific pesticide residue that is legally permitted to remain on or in food products and agricultural

Click Here to Buy book on Amazon

commodities. This limit is set to ensure consumer safety while verifying compliance with Good Agricultural Practices.

62. (A) Standard unit operations like washing, peeling, and blanching generally reduce surface contact pesticide residues.
Food processing techniques can significantly alter pesticide residue levels on agricultural commodities. Standard domestic and industrial preparation steps, including washing with water, physical peeling, and thermal blanching, are highly effective at removing or degrading non-systemic, surface-contact pesticide residues. In contrast, systemic pesticides absorbed into plant tissues are more resistant to physical removal.

63. (D) A is false but R is true.
The Acceptable Daily Intake and Maximum Residue Limit are different toxicological and regulatory values. The ADI is a health-based limit expressed in milligrams per kilogram of body weight, representing safe lifetime daily exposure. The MRL is a specific trade limit expressed in milligrams per kilogram of food, set much lower than toxicological thresholds to reflect proper pesticide use.

64. (D) Multi-residue methods (MRMs) are incapable of detecting more than one class of pesticide simultaneously.
Pesticide residue analysis requires advanced sample preparation and analytical techniques. Thorough sample homogenization is essential for representative testing, while matrix effects in mass spectrometry must be managed using internal standards to prevent analytical errors. Multi-residue methods are specifically designed to extract and detect hundreds of different pesticide classes simultaneously in a single analytical run.

65. (C) Theoretical Maximum Daily Intake (TMDI)
Dietary risk assessment utilizes exposure models to estimate human pesticide intake. Multiplying the established Maximum Residue Limit of a pesticide on a crop by the average daily consumption rate of that crop yields the Theoretical Maximum Daily Intake. This calculation represents a highly conservative, worst-case exposure estimate used to verify consumer safety.

66. (A) P-IV, Q-II, R-III, S-I
Toxicological terms describe specific adverse health outcomes and durations of exposure. Acute toxicity refers to harmful effects occurring shortly after a single dose. Chronic toxicity describes damage from long-term, continuous exposure. Teratogenicity is the capacity to cause structural defects in a developing fetus, while carcinogenicity is the ability of a substance to induce cancer over time.

67. (D) Complete elimination of the need for any analytical instrumentation like GC-MS or LC-MS.
The QuEChERS method offers numerous benefits for pesticide residue analysis, including high sample throughput, reduced solvent waste, and excellent recovery across different polarities. However, it is strictly a sample preparation and cleanup technique. It does not eliminate the need for downstream analytical instruments like gas or liquid chromatography-mass spectrometry, which are required for detection and quantification.

68. (C) Statement I is correct but Statement II is incorrect.
Endocrine-disrupting pesticides pose a unique toxicological concern because they can mimic, block, or alter natural hormone pathways in the human body. Unlike traditional toxicants that follow linear dose-response relationships, endocrine disruptors frequently exhibit non-monotonic dose-response curves, meaning they can cause significant biological and developmental effects at extremely low doses.

69. (C) 1, 2, and 3
Endocrine-disrupting chemicals in pesticides can alter reproductive, developmental, and metabolic functions in humans and wildlife. Substances like atrazine and vinclozolin are well-documented examples of these chemicals. Because they disrupt hormonal balance, their adverse effects can manifest at low doses below standard toxicological thresholds, targeting multiple endocrine organs, including thyroid and sex glands.

70. (A) Glyphosate – Subject of extensive global debate and IARC classification regarding its potential carcinogenicity.
Pesticides are linked to specific chronic health outcomes under scientific study. Glyphosate has been the subject of extensive international debate and was classified by the International Agency for Research on Cancer as probably carcinogenic to humans. This contrasts with acute organophosphates, which disrupt

NODIA

neurotransmission, and does not involve rapid tissue calcification or nutrient mimicry.

71. (D) The lack of international harmonization of MRLs, requiring exporters to comply with destination regulations.
Trade disputes often arise due to differences in pesticide regulations among nations. This scenario illustrates the challenges caused by a lack of international harmonization of Maximum Residue Limits. Exporting companies must comply with the specific import standards of the destination country, even if those limits are significantly stricter than the regulations in their home nation.

72. (B) Parkinson's disease
Chronic, long-term exposure to certain pesticides has been epidemiologically linked to elevated risks of neurodegenerative disorders. Specifically, these chemicals can induce oxidative stress and mitochondrial dysfunction, leading to the selective degeneration of dopaminergic neurons in the substantia nigra. This pathological process is the primary cause of motor symptoms in Parkinson's disease.

73. (C) Chronic Effect – Dizziness occurring 10 minutes after inhaling fumigant gas
Toxicological effects are classified by the timing of their onset and duration. Acute effects, such as nausea or contact dermatitis, occur almost immediately after exposure. Chronic effects, including tumor development, manifest after long-term, repeated low-level exposure. Dizziness occurring ten minutes after inhaling a toxic gas is an acute physiological reaction, not a chronic effect.

74. (D) Recommend stringent mitigation measures, lowering of MRLs, or restricted use of the pesticide to reduce EDI.
During dietary risk assessments, if the Estimated Daily Intake of a pesticide exceeds the safe Acceptable Daily Intake, regulators must intervene to protect public health. The appropriate regulatory response involves implementing mitigation measures, such as lowering maximum residue limits, extending pre-harvest intervals, or restricting the pesticide's registration and application to reduce consumer exposure.

75. (A) 3, 1, 2, 4
The QuEChERS analytical method follows a strict, logical sequence of sample preparation steps. The process begins by weighing the homogenized food sample and adding acetonitrile solvent. Next, extraction salts are added to induce phase separation. Dispersive solid-phase extraction cleanup is then performed using specific sorbents. Finally, the cleaned extract is injected into chromatographic instruments for quantification.

76. (B) Any material used or designed to make food unsafe, sub-standard, misbranded, or contain extraneous matter.
Under food safety laws, an adulterant is defined as any material or substance used to make food products unsafe, sub-standard, misbranded, or contaminated with extraneous matter. This definition covers both intentional additives used for fraudulent economic gain and accidental foreign matter, establishing a legal basis for prosecuting activities that compromise food quality or safety.

NODIA

77. (B) Incidental adulteration involves the accidental inclusion of contaminants like metallic shavings or insect fragments.
Food adulteration is classified into distinct categories based on intent. Intentional adulteration is the deliberate addition of prohibited substances to increase profits. Incidental adulteration involves the non-deliberate, accidental entry of foreign materials, such as metal shavings, dust, or insect fragments, during processing. Economically motivated adulteration is driven by financial gain, not public harm.

78. (C) A is true but R is false.
The addition of urea and detergents to water-diluted milk represents a hazardous form of intentional adulteration. These synthetic chemicals are added illegally to mimic the natural physical appearance of milk and artificially elevate the nitrogen content, masking dilution. They do not increase the natural fat content produced by the mammary gland, which is a physiological process.

79. (C) Metanil yellow is an approved, safe, food-grade dye legally permitted in turmeric powder.
Adulterants are unauthorized substances that compromise food safety. Starch in milk, argemone oil in mustard oil, and papaya seeds in black pepper are common examples of economic adulteration. Metanil yellow is an industrial non-permitted synthetic dye, not an approved food-grade color, and its addition to turmeric powder is illegal due to its neurotoxic properties.

80. (D) Baudouin Test
The Baudouin test is a specific chemical reaction used by food analysts to detect the adulteration of pure ghee with hydrogenated vegetable oil, also known as Vanaspati. This test detects the presence of sesame oil, which is legally mandated to be added to Vanaspati as a chemical marker, by reacting it with furfural to produce a distinctive pink color.

81. (A) P-II, Q-III, R-IV, S-I
Traditional food adulteration involves replacing high-value items with cheaper, morphologically similar materials. Black pepper is commonly adulterated with papaya seeds. Chili powder is often mixed with brick powder or carcinogenic Sudan Red dye. Coriander powder is adulterated with sawdust or horse dung, while honey is frequently diluted with high-fructose corn syrup or invert sugar.

82. (B) Gradual development of atherosclerosis over 20 years
Consuming adulterated food can result in immediate, severe health consequences. Examples of acute toxicity include severe gastrointestinal distress, sudden outbreaks of epidemic dropsy from argemone oil, and acute renal failure from melamine-tainted dairy. The gradual development of atherosclerosis over twenty years is a chronic cardiovascular disease linked to overall lifestyle, not an acute toxic reaction.

83. (C) Statement I is correct but Statement II is incorrect.
Food fraud is a broad concept encompassing the deliberate substitution, dilution, tampering, or misrepresentation of food products primarily for financial gain. Accidental contamination, such as a localized pest infestation in a warehouse, lacks the intent to deceive or defraud. Therefore, it is prosecuted under negligence or sanitation violations, rather than as deliberate food fraud.

84. (B) 2 and 3
Adulterants in milk serve different illegal purposes. While water and starch are added to increase volume and thickness, chemical substances like formalin and hydrogen peroxide are used illegally as preservatives. These hazardous chemicals are added to inhibit bacterial growth and artificially extend the shelf life of milk, bypassing the need for proper cold chain storage.

85. (C) Detection of Starch – Adding iodine solution to the sample produces a characteristic blue color.
Detecting milk adulterants relies on specific chemical reactions. The presence of starch is confirmed by adding iodine solution to the milk sample, which reacts with amylose to produce a characteristic deep blue color. Other tests, like measuring specific gravity or observing foam, are indirect and less specific than targeted chemical or enzymatic identification methods.

86. (A) Adulteration with Argemone mexicana seed oil
A sudden outbreak of bilateral pitting edema, erythema, and breathlessness linked to consuming locally pressed mustard oil indicates epidemic dropsy. This condition is caused by the accidental or deliberate adulteration of mustard oil with Argemone mexicana seed oil. The toxic alkaloid sanguinarine in argemone oil damages capillaries, causing extensive systemic fluid leakage.

87. (D) High cultivation costs and intensive labor drive unethical vendors to substitute with cheap, morphologically similar materials.
Economically motivated adulteration is driven by financial incentives. High-value spices like saffron and cardamom require intensive manual labor and high cultivation costs, making them expensive. Unethical vendors substitute these premium products with cheaper, morphologically similar materials, such as exhausted plant parts or dyed fibers, to reduce production costs and maximize illegal profit margins.

88. (B) Chicory (in Coffee) – Potent acute neurotoxin causing immediate paralysis
Food adulterants present distinct health hazards. Lead chromate is neurotoxic, Sudan dyes are carcinogenic, and melamine causes renal damage. In contrast, chicory is a roasted plant root commonly mixed with coffee; while its undeclared addition constitutes economic adulteration and misbranding, it is non-toxic and does not act as a potent neurotoxin causing immediate paralysis.

89. (C) Ignite the foil; pure silver foil crumbles into a grayish-black ash, while aluminum turns black but leaves a residue.
To distinguish pure silver foil from cheap aluminum substitutes on sweets, inspectors can perform a simple thermal field test. When exposed to a direct flame, pure silver foil crumbles easily into grayish-black ash. In contrast, aluminum

Downloaded from www.pdf.tube

foil oxidizes and turns black but maintains its structural shape, resisting crumbling and leaving a metallic residue.

90. (D) Liquid Chromatography coupled with tandem Mass Spectrometry (LC-MS/MS) for molecular confirmation.
Melamine is an industrial chemical rich in nitrogen, used illegally to artificially inflate protein measurements in dairy products. Simple field tests and physical measurements cannot definitively identify this compound at trace levels. Definitive detection and quantification require advanced analytical methods, specifically liquid chromatography coupled with tandem mass spectrometry, which provides precise molecular confirmation.

91. (A) Furfural, which reacts with sesame oil (mandatorily added to Vanaspati) yielding a pink color.
The Baudouin test detects the adulteration of pure ghee with hydrogenated vegetable oil by identifying sesame oil, which is legally required in Vanaspati. The test uses furfural in the presence of concentrated hydrochloric acid. This reagent reacts with sesamolin in the sesame oil, producing a distinctive pink or crimson color in the acid layer.

92. (B) Kesari dal (Lathyrus sativus) is often used to adulterate arhar/toor dal and can cause the neurotoxic disease Lathyrism.
Adulteration of pulses involves substituting high-value split peas with cheaper legumes. Kesari dal is frequently mixed with toor dal due to physical similarities. Chronic consumption of Kesari dal introduces the neurotoxin beta-N-oxalyl-L-alpha-beta-diaminopropionic acid into the diet, which damages upper motor neurons, causing the irreversible paralytic disease known as neurolathyrism.

93. (C) A is true but R is false.
The use of calcium carbide as an artificial ripening agent for fruits is strictly prohibited under food safety laws. When exposed to moisture, calcium carbide releases acetylene gas, which mimics ethylene to accelerate ripening. However, industrial-grade calcium carbide is often contaminated with toxic impurities, specifically arsenic and phosphorus hydrides, posing severe health risks to consumers.

94. (A) The presence of Argemone oil in edible oils is confirmed by a simple iodine starch reaction resulting in a deep blue color.
Iodine-starch reactions are used specifically to detect starch, not argemone oil. The presence of argemone oil in edible oils is verified using the nitric acid test, which produces a reddish-brown color, or by chromatography. Other tests, such as settling chalk in water or using hydrochloric acid for metanil yellow, are valid qualitative screening methods.

95. (C) Lead Chromate
Unscrupulous spice processors may use industrial pigments to enhance the bright yellow color of turmeric powder. The primary chemical contaminant of concern in this scenario is lead chromate, an industrial pigment. This compound is highly toxic, causing cumulative lead poisoning, neurological damage, and severe anemia, making its detection in food a critical safety priority.

96. (A) P-III, Q-I, R-II, S-IV
Simple field tests help identify common food adulterants. Rubbing green vegetables on the palms can reveal artificial colors like malachite green. A magnet passed through tea leaves separates iron filings. Dissolving coriander powder in water causes sawdust to float, while adding iodine to khoya or mawa produces a blue color if starch is present.

97. (C) Monosodium glutamate (MSG)
Edible cooking oils are vulnerable to economic adulteration with cheaper liquid hydrocarbons or non-permitted seed oils. Common oil adulterants include mineral oil, castor oil, and toxic argemone oil. Monosodium glutamate is a sodium salt of glutamic acid used as a flavor enhancer in savory foods; it is a crystalline solid and is not used as an oil adulterant.

98. (A) Both Statement I and Statement II are correct.
Food safety regulation in India underwent a major consolidation with the enactment of the Food Safety and Standards Act of 2006. This comprehensive legislation unified multiple old, fragmented food laws. It formally repealed and replaced the older Prevention of Food Adulteration Act of 1954, establishing a single modern regulatory authority to govern national food standards.

NODIA

99. (A) 1, 2, and 4
Mitigating heavy metal contamination in the food chain requires targeted agricultural and industrial strategies. Phytoextraction using hyperaccumulator plants can remove metals from soil, while adjusting soil pH with lime reduces their bioavailability to crops. Industrial effluent treatment prevents water contamination. Thermal processing, however, cannot vaporize or destroy elemental heavy metals, as they are non-volatile.

100. (A) Hydrogen Peroxide in milk – Paraphenylenediamine test (turns blue)
Food analysts utilize specific chemical reagents to identify adulterants in milk. The presence of hydrogen peroxide is detected using the paraphenylenediamine test, which produces a characteristic blue color. Other adulterants, such as starch, formalin, and urea, require different chemical reagents, like iodine, sulfuric acid with ferric chloride, and dimethylaminobenzaldehyde, respectively, to yield positive color reactions.

101. (C) Malachite green
To make stale green vegetables look fresh, unscrupulous vendors may treat them with unauthorized synthetic dyes. Malachite green is an industrial dye used illegally on green peas to impart an unnaturally bright green color that resists boiling. This dye is highly toxic and carcinogenic, making its use on food products strictly prohibited under safety regulations.

102. (A) Consumption of mustard oil containing Argemone mexicana seed oil, which introduces sanguinarine, causing capillary leakage.
Epidemic dropsy is a clinical syndrome caused by consuming mustard oil adulterated with Argemone mexicana seed oil. The active toxin sanguinarine inhibits sodium-potassium adenosine triphosphatase in blood vessels. This biochemical disruption leads to increased capillary permeability and leakage, causing severe bilateral pitting edema, erythema, localized swelling, and cardiovascular complications in affected individuals.

103. (D) Extraneous matter – Intentional, high-toxicity synthetic chemicals added strictly for shelf-life extension
Legal food safety frameworks define distinct types of non-compliance. Sub-standard food fails quality parameters but is safe, while unsafe food presents health risks. Misbranded food involves deceptive labeling. Extraneous matter refers to accidental foreign materials, such as dust, pebbles, or insect parts, rather than synthetic chemical preservatives intentionally added to extend a product's shelf life.

104. (B) Unsafe food
Dairy products manufactured using synthetic materials like detergents, urea, and industrial fats present serious health hazards. Under standard food safety regulations, any food product containing highly toxic or non-permitted chemical substances that render it injurious to human health is classified as unsafe food. This classification enables regulatory authorities to initiate immediate product recalls and criminal prosecutions.

105. (A) 2, 4, 1, 3
Authorized food safety inspectors follow a strict statutory sequence when drawing samples for analysis. First, the inspector serves a formal notice of intent to the food business operator. Next, they pay the cost of the sampled food and obtain a receipt. They then divide the sample into four sealed parts before sending one part to the analyst.

106. (D) Clove
Economically motivated adulteration often involves mixing genuine spices with exhausted spices of the same type from which the essential oils have been extracted. Whole cloves are highly vulnerable to this practice. Because exhausted cloves look identical to genuine ones, identifying this adulteration requires chemical profiling to measure the concentration of active volatile oils like eugenol.

107. (A) Initiatives like rapid test kits (e.g., 'Detect Adulteration with Rapid Test') empower consumers to screen for common adulterants at home.
Raising consumer awareness is a key strategy for reducing food adulteration. Programs like DART provide simplified, rapid test kits that enable citizens to screen everyday foods for common adulterants at home. This active involvement helps detect fraudulent practices at the local level and supports regulatory enforcement by encouraging the reporting of suspicious products.

Click Here to Buy book on Amazon

108. (A) Both A and R are true and R is the correct explanation of A.
Detecting modern food fraud requires advanced analytical technologies. Unscrupulous actors use highly sophisticated methods to adulterate food, carefully matching physical and chemical parameters like nitrogen or sugar profiles to mimic authentic products. Consequently, simple tests are often insufficient, necessitating advanced techniques like stable isotope ratio mass spectrometry or DNA barcoding to verify geographical origin and authenticity.

109. (B) The substitution of high-value Extra Virgin Olive Oil with cheaper soybean oil is an example of accidental contamination.
Food safety management distinguishes between intentional fraud and accidental contamination. The substitution of premium extra virgin olive oil with cheaper soybean oil is a deliberate act of deception for economic gain, which constitutes food fraud rather than accidental contamination. Accidental contamination occurs without intent to deceive, arising from processing errors or environmental exposure.

110. (A) High-pressure washing with potable water and peeling.
In food processing, unit operations can be optimized to reduce chemical contaminant levels. For non-systemic, surface-contact pesticides, high-pressure washing with potable water combined with mechanical peeling of the outer skin is highly effective. This physical separation removes residues from the surface before the vegetables enter the canning process, protecting consumer safety.

111. (A) P-II, Q-I, R-III, S-IV
National food safety acts establish legal provisions and administrative roles to protect consumers. Fines and punishments are defined for selling unsafe food, while inspectors are granted statutory powers to draw samples and audit premises. The appellate tribunal hears appeals against administrative decisions, and independent scientific panels provide expert advice and risk assessments.

112. (D) The specific heat capacity of the final packaged product
Food fraud vulnerability assessments focus on identifying factors that make a food material a target for economic deception. Key elements evaluated include the historical incidence of fraud, supply chain complexity, geopolitical stability of source regions, and economic anomalies like sudden price fluctuations. Physical properties like specific heat capacity are irrelevant to assessing fraud vulnerability.

113. (D) Statement I is incorrect but Statement II is correct.
Rapid food testing kits are not designed for precise laboratory quantification of trace contaminants like heavy metals. Instead, they are simplified, portable tools containing basic reagents and apparatus. These kits allow consumers, schools, and field officers to perform rapid, qualitative color tests to detect common adulterants, helping to raise public awareness about food safety.

114. (A) 1, 2, and 3
Reducing chemical contaminant levels requires scientifically sound and legally compliant strategies. Implementing Good Agricultural Practices reduces pesticide residues at the farm level, while activated carbon filtration removes chemical impurities during liquid food processing. HACCP systems help identify and control chemical hazards, whereas raising legal maximum residue limits is not a valid safety strategy.

115. (D) Traceability – The ability to track any food through all stages of production, processing, and distribution.
Food safety regulations use precise terms to define compliance processes. Traceability is the ability to track and follow a food product, feed-producing animal, or chemical substance through all stages of production, processing, and distribution. This capability is critical for identifying the source of contamination and executing targeted product recalls to protect public health.

116. (A) Antimony / Arsenic impurities
Counterfeit silver foil used on confectionery may contain toxic heavy metal impurities. When treated with hydrochloric acid, these impure metal foils can react to release gases like stibine or arsine, which have a characteristic garlic-like odor. Pure silver foil does not react with hydrochloric acid in this manner, making this chemical test useful for detecting counterfeit foil.

NODIA

117. (C) Banning untreated industrial wastewater for agricultural irrigation to prevent Cadmium uptake in crops.
Preventing heavy metal contamination is most effective when addressed at the environmental source. Banning the discharge of untreated industrial wastewater for agricultural irrigation directly reduces the concentration of cadmium in soil and water. This preventive measure stops the uptake and bioaccumulation of toxic metals by crops, protecting the food chain before harvesting occurs.

118. (A) Food Safety Advisory Cell – National police force dedicated strictly to arresting food adulterators
Food safety authorities operate under administrative law rather than direct police enforcement. The central food authority establishes national standards, consumer initiatives promote safe food habits, and online portals manage licensing. The advisory cell provides policy guidance and is not a national police force empowered to arrest food business operators.

119. (D) The pesticide residues on harvested tomatoes will likely exceed the statutory Maximum Residue Limits (MRL).
The Pre-Harvest Interval is the mandatory waiting period between the last pesticide application and crop harvest, allowing residues to degrade to safe levels. Violating this interval by harvesting crops early prevents the chemical from breaking down, making it highly probable that the pesticide residues on the harvested food will exceed the statutory Maximum Residue Limits.

120. (B) Establishing robust monitoring, enforcing Good Agricultural Practices, and continuous farmer training.
Ensuring long-term compliance with pesticide residue limits requires a comprehensive regulatory strategy. This includes establishing robust environmental monitoring systems, enforcing Good Agricultural Practices, and providing continuous training to farmers on proper pesticide application and pre-harvest intervals. This multi-faceted approach reduces residue levels at the source while maintaining agricultural productivity and safety.

121. (C) Bioaccumulation
Bioaccumulation is the toxicological process by which the concentration of a chemical substance increases in a biological organism over time. This occurs when the rate of chemical absorption through all exposure routes, including food, water, and inhalation, exceeds the rate at which the organism can metabolize or excrete the substance from its tissues.

122. (D) Observing the recommended PHI ensures that pesticide residues degrade to levels at or below the legal MRL before harvest.
The Pre-Harvest Interval is a critical agricultural parameter established during pesticide registration. Observing this recommended waiting period allows natural processes like sunlight, rain, and plant metabolism to degrade chemical residues. This ensures that the pesticide concentration on harvested crops falls to or below the legally permitted Maximum Residue Limit, protecting consumers from excessive exposure.

123. (A) Both A and R are true and R is the correct explanation of A.
Endocrine-disrupting pesticides present unique challenges for environmental toxicologists and food safety regulators. Unlike traditional chemicals that exhibit linear toxicity, these compounds can disrupt hormone pathways and cause significant developmental or reproductive effects at very low doses. This non-monotonic dose-response relationship complicates the process of setting safe daily intake levels using standard risk assessment models.

124. (B) It is synonymous with standard food spoilage caused by inadequate refrigeration.
Food fraud is characterized by the deliberate intent to deceive consumers or regulators, typically for economic gain. This includes practices like misrepresenting geographical origin, using unapproved additives, or counterfeiting brands. In contrast, food spoilage caused by inadequate refrigeration is a physical and biological process of decay, which represents a quality or sanitation failure rather than fraud.

125. (B) Extensive dry milling and separation of the bran layer.
Heavy metals from atmospheric deposition or soil contact often concentrate on the outer surface of cereal grains. In grain processing, dry milling and physical separation of the outer bran layer

Downloaded from www.pdf.tube

are highly effective at reducing these surface contaminants. This unit operation concentrates the heavy metals in the by-products, lowering their levels in the final refined flour.

126. (A) P-IV, Q-I, R-III, S-II
Chemical analysis of food adulteration relies on specific color-forming reactions. The iodine test yields a deep blue color when reacting with starch. The Baudouin test produces a pink or crimson color in the acid layer in the presence of sesame oil. The nitric acid test generates a red-brown color for argemone oil, while hydrochloric acid turns metanil yellow magenta-red.

127. (C) Economic Profitability Assessment
The international scientific framework for evaluating chemical hazards in food consists of four core components: hazard identification, hazard characterization, exposure assessment, and risk characterization. These steps focus on evaluating toxicological data and dietary intake levels to protect health. Evaluating the economic profitability of a food product is not a component of safety risk assessments.

128. (D) Statement I is incorrect but Statement II is correct.
The apex food regulatory authority in India, the Food Safety and Standards Authority of India, operates under the administrative control of the Ministry of Health and Family Welfare, not the Ministry of Agriculture. This authority is responsible for establishing science-based food standards and regulating the manufacture, storage, distribution, sale, and import of food.

129. (B) 1, 2, and 4
Preventing heavy metal contamination during food processing requires targeted quality control measures. These include using food-grade stainless steel for processing equipment, sourcing agricultural raw materials from regions free of industrial effluents, and calibrating machinery to prevent metal shedding. Completely eliminating water from food formulations is impractical and unnecessary for managing heavy metal hazards.

130. (B) Implementation of Integrated Pest Management (IPM) – Reduction of reliance on chemical pesticides.
Food safety management involves applying target strategies to control specific hazards. Implementing Integrated Pest Management is a highly effective agricultural strategy that combines biological, physical, and cultural control methods. This approach reduces reliance on chemical synthetic pesticides, lowering the levels of chemical residues in the environment and on harvested crops.

131. (D) Economically Motated Adulteration and Misbranding.
Diluting pure honey with cheaper high-fructose corn syrup while labeling the product as pure honey is a fraudulent practice. This activity constitutes economically motivated adulteration because a cheaper ingredient is used to inflate profits. It also represents misbranding, as the product label contains false and deceptive claims regarding the composition and quality of the food.

132. (A) It allows rapid identification, isolation, and targeted recall of contaminated batches from the supply chain.
Traceability systems are critical for managing food safety incidents. By tracking products through every stage of the supply chain, regulators and manufacturers can quickly identify the source of contamination, locate affected batches, and execute targeted product recalls. This rapid response prevents contaminated food from reaching consumers, minimizing public health risks.

NODIA

133. (C) Penalty for manufacturing food without an ISO 9001 certification – Imprisonment
Food safety laws define specific penalties for statutory violations. Selling sub-standard, misbranded, or quality-deficient food results in financial penalties. However, manufacturing food without ISO nine-thousand-one certification is not a statutory crime carrying imprisonment. ISO standards are voluntary quality management systems, distinct from the mandatory food safety regulations enforced by governments.

134. (A) The proper selection, use, and decontamination of Personal Protective Equipment (PPE).
Protecting agricultural workers from the acute toxicity of organophosphate pesticides requires prioritizing occupational safety training. The most critical topic is the proper selection, use, and decontamination of personal protective equipment, such as gloves, masks, and aprons. This training directly prevents dermal absorption and inhalation of toxic chemicals, reducing the risk of acute poisoning.

135. (A) 3, 4, 2, 1
Quantitative risk assessment follows a structured four-step scientific process. It begins with hazard identification, which determines whether a chemical causes adverse health effects. Next, hazard characterization establishes the dose-response relationship. Exposure assessment then estimates human dietary intake levels. Finally, risk characterization integrates this information to evaluate the overall health risk to the population.

136. (B) Detect Adulteration with Rapid Test
The acronym DART stands for Detect Adulteration with Rapid Test, which is an initiative launched by national food safety authorities. This program provides simplified, qualitative testing guidelines that allow consumers to screen common foods for adulterants at home. The goal is to improve food safety awareness and empower citizens to identify sub-standard products.

137. (C) They are empowered to sample food from any food business operator and send them to an analyst to verify safety compliance.
Food safety inspectors play a vital role in enforcing compliance with national food standards. They are legally empowered to enter food premises, inspect hygiene conditions, audit documentation, and draw representative samples of food or ingredients. These samples are sent to accredited analysts to verify safety compliance, helping to protect consumers from unsafe or adulterated food.

138. (A) Both A and R are true and R is the correct explanation of A.
Risk communication is a continuous, interactive exchange of information and opinions regarding hazards among risk assessors, managers, consumers, and other stakeholders. Providing transparent, science-based information about food contaminants helps prevent public panic, builds trust in regulatory systems, and ensures that consumers can make informed decisions to protect their health.

139. (A) They serve as the primary legal platform where inspectors upload confidential prosecution records.
Public education portals managed by food safety authorities are designed to raise consumer awareness and promote safe food habits. These interactive platforms provide practical guidance on safe food handling, hygiene, and nutrition in homes, schools, and workplaces. They do not serve as administrative platforms for uploading confidential legal prosecution records, which are restricted.

140. (B) Physical Matter; Retain the sealed bottle, note batch details, and register a complaint on the official regulatory grievance portal.
Finding a dead insect in a beverage represents a physical contamination hazard. To address this issue, consumers should preserve the sample in its container, record the batch number and manufacturing details, and file a formal complaint through the official food safety grievance portal. This action allows regulators to investigate potential hygiene failures at the manufacturing facility.

141. (A) P-II, Q-III, R-IV, S-I
Food safety management involves multiple national and international organizations. National food authorities establish science-based standards at the domestic level, while laboratory accreditation boards verify testing competency. Internationally, the Codex Alimentarius Commission develops global food standards, and the Joint FAO/WHO Expert Committee on Food Additives conducts scientific safety evaluations of additives and contaminants.

142. (A) Setting the Maximum Retail Price (MRP) for agricultural commodities.
The core mandate of a national food safety authority is to protect public health by setting science-based food standards, licensing food businesses, and managing food safety alerts. These regulatory bodies focus on safety, hygiene, and quality parameters. Setting the maximum retail price of commodities is an economic function managed by agricultural or consumer affairs ministries.

143. (D) Statement I is incorrect but Statement II is correct.
Standards established by the Codex Alimentarius Commission are voluntary guidelines designed to facilitate international trade and protect consumer health. They are not legally binding treaties that nations must adopt. Instead, national food authorities use Codex standards as scientific reference points, harmonizing domestic regulations while accounting for local dietary habits and exposure profiles.

Click Here to Buy book on Amazon

144. (A) 1, 2, and 3
Consumer protection frameworks employ multiple regulatory tools to manage food safety. These include mandatory ingredient and allergen labeling on packages, dedicated appellate tribunals for rapid resolution of legal disputes, and online reporting portals for citizens. Requiring regular, mandatory blood tests of all consumers by health departments is not a standard regulatory practice.

145. (C) Designated Officer (DO) – The authority who issues or cancels FBO licenses in a specific district.
Legal food safety systems define specific administrative roles. The Designated Officer is the key regulatory authority at the district level responsible for issuing or cancelling food business licenses. Food analysts perform laboratory testing, food safety officers conduct inspections, and food business operators are the commercial entities manufacturing or distributing food products.

146. (B) Conduct rapid sampling, analyze against standards, and transparently release verified data and advisories to the public.
During public concern over potential water contamination, regulatory authorities must implement effective risk communication. The appropriate response involves conducting rapid water sampling, analyzing the samples against established safety standards, and transparently releasing verified scientific data to the public. This evidence-based approach addresses safety concerns and prevents unnecessary public panic.

147. (D) To deter fraudulent practices by making the financial and legal risks far outweigh potential illegal profits, protecting the food supply.
Enforcing strict penalties for economically motivated adulteration is designed to protect consumers and maintain market integrity. By imposing significant financial and legal consequences, regulators aim to deter fraudulent practices. This approach ensures that the risks of adulteration outweigh potential illegal profits, encouraging compliance and protecting the safety of the food supply chain.

148. (A) Agricultural Extension Officer – Holds exclusive legal power to penalize food adulterators in court.
Enforcing food safety laws involves specific, authorized personnel. Food safety officers inspect facilities and collect samples, analysts perform laboratory testing, and commissioners head state-level enforcement. Agricultural extension officers provide training to farmers but do not hold the statutory legal authority to prosecute or penalize food adulteration in court.

149. (C) Demonstrating simple rapid tests from the consumer safety manuals to detect common adulterants like starch and chalk.
Organizing effective food safety training in rural communities requires using practical, accessible educational methods. Demonstrating simple, low-cost rapid tests to identify common adulterants, such as starch in dairy or chalk in sugar, is highly effective. This hands-on training empowers consumers to protect themselves without needing complex scientific degrees or expensive laboratory equipment.

150. (A) To ensure the availability of safe and wholesome food for human consumption and protect public health.
The primary, overarching objective of food safety legislation and the regulation of contaminants, pesticides, and adulterants is to protect public health. These laws establish standards to ensure that food available for human consumption is safe, wholesome, and properly labeled. This regulatory framework builds consumer trust and supports safe trade.

www.nodia.in

Downloaded from www.pdf.tube

CHAPTER 04

Anti-Nutritional Factors and Enzymes in Food

1. Which of the following best describes the primary characteristic of anti-nutritional factors (ANFs) in food?
(A) They are synthetic chemical additives introduced during food processing to extend storage shelf life.
(B) They are natural compounds that interfere with the digestion, absorption, or utilization of nutrients.
(C) They are biologically active peptides that function primarily to enhance human systemic immune responses.
(D) They are toxic microbial byproducts that trigger foodborne illnesses when consumed in trace amounts.

2. Match the Anti-Nutritional Factors in List I with their primary food sources in List II.
List I: (Anti-Nutritional Factors)
P. Phytic acid
Q. Glucosinolates
R. Gossypol
S. Solanine
List II: (Primary Food Sources)
I. Cottonseed
II. Cabbage and Mustard
III. Wheat bran and Legumes
IV. Green potatoes
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-III, R-I, S-IV
(C) P-III, Q-I, R-II, S-IV
(D) P-I, Q-II, R-IV, S-III

3. Which of the following statements correctly describes the structural basis for the anti-nutritional activity of phytic acid?
(A) It possesses six phosphate groups on a myo-inositol ring, chelating divalent cations via its strong charge.
(B) It contains a cyclic lipopeptide structure that spontaneously forms functional pores in intestinal membranes.
(C) It acts as a competitive inhibitor of pancreatic amylase because of its structural similarity to amylopectin.
(D) It is a glycosylated protein that binds specifically and exclusively to sialic acid residues on erythrocytes.

4. Phytic acid is chemically defined as:
(A) D-chiro-inositol tetrakisphosphate
(B) Galacturonic acid polyphosphate
(C) Myo-inositol hexakisphosphate
(D) Epigallocatechin gallate

5. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): The bioavailability of dietary iron and zinc is significantly reduced in populations consuming unfermented whole grain cereals as a staple.
Reason (R): Whole grain cereals contain high levels of phytates, which form insoluble complexes with multivalent metal ions in the gastrointestinal tract.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

6. Which of the following naturally occurring compounds is NOT generally classified as an anti-nutritional factor?
(A) Trypsin inhibitors
(B) Cyanogenic glycosides
(C) Haemagglutinins
(D) Anthocyanins

7. Consider the following methods used to reduce phytate content in foods:
I. Germination
II. Lactic acid fermentation
III. Milling to remove the bran layer
IV. Addition of exogenous phytase

NODIA

Which of the above methods rely primarily on enzymatic hydrolysis to reduce phytate levels?
(A) I and II only
(B) I, II, and IV only
(C) III and IV only
(D) I, II, III, and IV

8. Given below are two statements:
Statement I: Phytases catalyze the sequential hydrolysis of phytic acid to lower myo-inositol phosphates and inorganic phosphate.
Statement II: Endogenous phytase activity in cereals is typically maximum at an alkaline pH of 8.5 to 9.0.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

9. A pediatric nutritionist is designing a complementary weaning food using a pearl millet base. The target population is prone to zinc deficiency. To maximize zinc bioavailability without compromising macronutrient density, which processing intervention should the nutritionist apply?
(A) Intense dry roasting at 180°C for 30 minutes
(B) Fortification with excess dietary fiber
(C) Extrusion cooking at ultra-high pressures with no moisture
(D) Soaking and malting the pearl millet before formulation

10. Which of the following statements regarding phytates is INCORRECT?
(A) Routine domestic boiling completely eliminates the anti-nutritional effect of phytates.
(B) Phytates function as the primary storage form of mineral phosphorus in plant seeds.
(C) Phytate-protein complex formation reduces protein digestibility in the human gut.
(D) Ascorbic acid can actively counteract the inhibitory effect of phytate on iron.

11. Arrange the following forms of inositol phosphates in the correct order of their sequential degradation by phytase, starting from the most phosphorylated to the least phosphorylated:
I. Inositol tetrakisphosphate (IP4)
II. Inositol hexakisphosphate (IP6)
III. Inositol bisphosphate (IP2)
IV. Inositol pentakisphosphate (IP5)
(A) II, I, IV, III
(B) II, IV, I, III
(C) IV, II, I, III
(D) II, IV, III, I

12. The formation of highly insoluble calcium-phytate complexes in the small intestine directly results in:
(A) Enhanced systemic absorption of non-heme iron in the duodenum
(B) Decreased biological availability of dietary calcium in the gut
(C) Increased endogenous synthesis of active vitamin D3 in skin
(D) Accelerated enzymatic hydrolysis of dietary lipids by lipase

13. Which of the following pairs of anti-nutritional factor and its physiological consequence is CORRECTLY matched?
(A) Phytic acid - Reduced bioavailability of zinc and iron
(B) Glucosinolates - Direct agglutination of red blood cells
(C) Tannins - Systemic inhibition of thyroid hormone synthesis
(D) Protease inhibitors - Binding and transport of cholesterol

14. A Food Safety Officer (FSO) analyzes a newly marketed "High-Fiber Iron Fortified Sorghum Flour." Despite containing 25 mg of added iron per 100g, clinical trials show negligible improvement in consumer serum ferritin levels. The FSO suspects an inherent component of the unrefined sorghum is interfering. Which factor is most likely responsible?
(A) High concentration of saponins causing acute red blood cell hemolysis
(B) Presence of active endogenous lipoxygenase directly destroying the iron
(C) High levels of phytic acid and tannins chelating the available iron
(D) High levels of naturally occurring cyanogenic glycosides in the flour

15. An R&D scientist must formulate a low-cost, protein-rich emergency relief food using soybeans and corn. To ensure maximum protein digestibility and mineral absorption, the optimal sequence of processing should be:
(A) Direct dry milling of the raw ingredients followed by protective nitrogen packaging

Click Here to Buy book on Amazon

(B) Cold-pressing of the oil fraction followed by rapid freezing of the residue
(C) Addition of synthetic chelating agents followed by high-dose gamma irradiation
(D) Soaking, followed by controlled thermal treatment and lactic acid fermentation

16. Which of the following vegetables is widely recognized for containing high levels of naturally occurring oxalates?
(A) Carrots
(B) Cabbage
(C) Spinach
(D) Green peas

17. Match the specific forms of oxalates in List I with their corresponding characteristics in List II.
List I: (Oxalate Forms and Related Terms)
P. Soluble oxalates
Q. Insoluble oxalates
R. Oxalobacter formigenes
S. Hyperoxaluria
List II: (Characteristics)
I. Gut bacterium that degrades oxalate
II. Primarily composed of calcium oxalate
III. Excessive urinary excretion of oxalate
IV. Primarily potassium and sodium salts
(A) P-IV, Q-II, R-I, S-III
(B) P-II, Q-IV, R-III, S-I
(C) P-IV, Q-II, R-III, S-I
(D) P-I, Q-III, R-II, S-IV

18. Which of the following statements regarding the interaction of oxalates with dietary minerals is correct?
(A) Oxalates primarily bind with monovalent cations, rendering them completely indigestible.
(B) Soluble oxalates enhance the bioavailability of non-heme iron by reducing ferric ions to ferrous ions.
(C) Boiling oxalate-rich vegetables increases the endogenous oxalate concentration due to thermal synthesis.
(D) Oxalic acid forms a highly insoluble complex with calcium, severely restricting calcium absorption.

19. Tannins are best defined as:
(A) Water-soluble polyphenolic compounds that can precipitate proteins.
(B) Low molecular weight aliphatic acids that sequester dietary calcium.
(C) Cyanogenic compounds found primarily in the endosperm of cereal grains.
(D) Heat-stable lipid derivatives that selectively inhibit pancreatic lipase.

20. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): Consumption of strong black tea immediately following an iron-rich vegetarian meal can lead to iron deficiency over time.
Reason (R): Tannins and other phenolic compounds in tea form insoluble complexes with non-heme iron in the intestinal lumen.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

21. Which of the following is NOT a recognized property of dietary tannins?
(A) Functioning as competitive inhibitors of the enzyme myrosinase
(B) Imparting astringency to foods and beverages
(C) Forming complexes with dietary proteins, reducing their digestibility
(D) Possessing antioxidant and free-radical scavenging activities

22. Consider the physiological effects of excessive oxalate consumption:
I. Increased risk of renal calculus (kidney stone) formation
II. Interference with calcium absorption
III. Systemic alkalinization of blood pH
IV. Depletion of mucosal surface zinc
Which of the above statements are correct?
(A) I and II only
(B) I, II, and IV only
(C) II and III only
(D) I, III, and IV only

23. Given below are two statements:
Statement I: Hydrolyzable tannins are composed of a central carbohydrate core to which phenolic carboxylic acids are esterified.
Statement II: Condensed tannins are polymers of flavan-3-ol units and are highly susceptible to enzymatic hydrolysis in the human gut.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.

NODIA

(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

24. A patient suffering from iron-deficiency anemia is advised by a dietitian to modify their beverage consumption habits. If the patient frequently consumes a beverage rich in gallotannins, the most scientifically sound advice is to:
(A) Increase the beverage intake during meals to significantly boost antioxidant defenses
(B) Consume the beverage concurrently with iron-rich meals to maximize absorption efficiency
(C) Separate the consumption of the beverage from iron-rich meals by at least two hours
(D) Boil the beverage for extended periods to convert complex tannins into bioavailable iron

25. Which of the following statements about oxalates in food is INCORRECT?
(A) Rhubarb leaves contain dangerously high levels of oxalic acid.
(B) Steaming or boiling spinach and discarding the cooking water effectively removes a significant portion of soluble oxalates.
(C) Insoluble calcium oxalate crystals in taro corms cause mechanical irritation to the mouth and throat.
(D) Oxalates act as primary antioxidants in the bloodstream, preventing lipid peroxidation.

26. To minimize the negative impact of high-oxalate foods like amaranth leaves on calcium bioavailability in a domestic setting, which is the MOST APPROPRIATE preparation method?
(A) Boiling the leaves in water and discarding the residual liquid
(B) Microwaving the fresh leaves at high power with no added water
(C) Sun-drying the leaves and grinding them into a fine raw powder
(D) Frying the leaves rapidly in a refined polyunsaturated cooking oil

27. The strong affinity of tannins for proline-rich proteins directly results in:
(A) The enzymatic browning of cut fruits
(B) The sensation of astringency in the oral cavity
(C) The hydrolysis of dietary starches
(D) The rapid denaturation of salivary amylase at acidic pH

28. Which of the following pairs representing an anti-nutritional factor and its notable food source is INCORRECTLY matched?
(A) Condensed Tannins - Sorghum
(B) Phytic acid - Egg whites
(C) Oxalates - Rhubarb
(D) Hydrolyzable Tannins - Pomegranates

29. A clinical dietitian evaluates a patient with recurrent calcium oxalate nephrolithiasis (kidney stones). The patient frequently consumes spinach salads, almonds, and black tea. What is the most biologically sound dietary intervention to manage oxalate absorption?
(A) Consume calcium-rich foods alongside oxalate-rich foods to bind oxalate in the gut.
(B) Completely eliminate all dietary calcium to prevent it from binding within the kidneys.
(C) Increase daily vitamin C supplementation up to 2000 mg to safely acidify the urine.
(D) Substitute black tea with green tea under the assumption that it lacks polyphenols.

30. An agricultural cooperative wants to process a high-tannin variety of sorghum to make it suitable for poultry feed. The most effective industrial processing step to specifically inactivate or reduce the anti-nutritional effects of tannins is:
(A) Subjecting the grains to high-intensity ultra-violet irradiation for 10 minutes
(B) Polishing the grain mechanically to remove only the innermost starch endosperm
(C) Treating the grains with alkaline solutions like ammonia or sodium hydroxide
(D) Storing the grain harvests in an anaerobic silo at sub-zero, freezing temperatures

31. Lectins, a distinct class of anti-nutritional factors found in legumes, are alternatively known as:
(A) Saponins
(B) Glucosinolates
(C) Amylase inhibitors
(D) Haemagglutinins

32. Match the specific protease inhibitors in List I with their defining structural/functional characteristics in List II.
List I: (Protease Inhibitors)
P. Kunitz inhibitor
Q. Bowman-Birk inhibitor
R. Cystatin
S. Ovomucoid
List II: (Characteristics)

Downloaded from www.pdf.tube

I. Double-headed inhibitor targeting both trypsin and chymotrypsin
II. Heat-labile, single polypeptide chain primarily inhibiting trypsin
III. Major protease inhibitor found in egg white
IV. Inhibitor of cysteine proteases
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-I, R-III, S-IV
(D) P-III, Q-IV, R-I, S-II

33. Which of the following statements correctly details the toxic mechanism of dietary lectins?
(A) They enzymatically cleave protein peptide bonds in the stomach, leading directly to toxic accumulation of active peptides.
(B) They bind to specific carbohydrate residues on the surface of intestinal epithelial cells, disrupting the brush border.
(C) They competitively inhibit pancreatic lipase by binding to its active catalytic site, preventing lipid digestion.
(D) They undergo rapid anaerobic fermentation in the colon to produce lethal systemic doses of toxic hydrogen cyanide.

34. Protease inhibitors in foods are defined as:
(A) Enzymatic proteins that irreversibly degrade dietary proteins into free amino acids prior to ingestion.
(B) Chemical preservatives added to meat products to prevent proteolytic spoilage by wild bacterial strains.
(C) Phenolic plant derivatives that cross-link structural proteins in the mucosal walls of the intestine.
(D) Proteins that form stable complexes with digestive enzymes like trypsin, reducing their activity.

35. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): Ingestion of raw or undercooked red kidney beans can cause severe acute gastroenteritis, nausea, and vomiting within a few hours.
Reason (R): Raw red kidney beans contain high levels of Phytohaemagglutinin (PHA), which is a heat-stable toxin unaffected by boiling.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

36. Which of the following is NOT a characteristic of the Kunitz trypsin inhibitor found in soybeans?
(A) It consists of a single polypeptide chain of approximately 21 kDa.
(B) It primarily exhibits a strong affinity for bovine trypsin.
(C) It is highly thermostable and can survive prolonged boiling at 100°C.
(D) Its inactivation during processing significantly improves the protein efficiency ratio (PER) of soy products.

37. Consider the following properties related to foodborne lectins:
I. They exhibit specific reversible carbohydrate-binding activity.
II. They are highly resistant to proteolytic degradation in the human gut.
III. They can cause hypertrophy of the pancreas due to cholecystokinin release.
IV. They are effectively inactivated by adequate wet thermal processing.
Which of these statements accurately describe lectins?
(A) I, II, and IV only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, III, and IV

38. Given below are two statements:
Statement I: The Bowman-Birk inhibitor found in soybeans contains multiple disulfide bonds, contributing to its high structural stability and resistance to thermal denaturation.
Statement II: The Bowman-Birk inhibitor exclusively binds to trypsin and shows no inhibitory activity against chymotrypsin.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

39. A catering company prepared a bean salad using kidney beans that were soaked overnight and cooked in a slow cooker at 75°C for 6 hours. Several guests subsequently developed severe nausea and diarrhea. The physiological cause of this outbreak is most likely:
(A) Complete structural destruction of essential dietary amino acids due to prolonged heating

NODIA

in the cooker.
(B) Incomplete denaturation of Phytohaemagglutinin (PHA) due to insufficient cooking temperature.
(C) Rapid release of toxic cyanogenic glycosides triggered directly by the slow cooker's low temperature.
(D) Conversion of digestible starches into resistant starches, causing acute colonic bacterial fermentation.

40. Which of the following statements regarding trypsin inhibitors is INCORRECT?
(A) Chronic consumption of active trypsin inhibitors can lead to pancreatic enlargement in monogastric animals.
(B) Trypsin inhibitors trigger the hypersecretion of cholecystokinin (CCK).
(C) Trypsin inhibitors function by permanently modifying the primary amino acid sequence of trypsinogen.
(D) Boiling legumes in water for 15-20 minutes is generally sufficient to inactivate most trypsin inhibitors.

41. Arrange the physiological events triggered by the ingestion of active trypsin inhibitors in the correct chronological sequence:
I. Hypersecretion of cholecystokinin (CCK) from the intestinal mucosa
II. Formation of irreversible trypsin-inhibitor complexes in the duodenum
III. Hypertrophy and hyperplasia of the pancreas
IV. Decrease in free trypsin levels in the gut lumen
(A) II, IV, I, III
(B) I, II, IV, III
(C) II, I, IV, III
(D) IV, II, III, I

42. The haemagglutination effect observed when crude lectin extracts are mixed with blood samples is directly caused by:
(A) Lectins binding to specific carbohydrate moieties on adjacent red blood cells, causing cross-linking.
(B) The direct proteolytic cleavage of functional hemoglobin molecules by active endogenous proteases.
(C) The rapid chelation of iron atoms from the heme porphyrin ring structure by organic plant acids.
(D) The rapid oxidation of ferrous ions to ferric ions catalyzed directly by lectin oxidase activity.

43. Which of the following pairs of plant source and its characteristic anti-nutritional protein is CORRECTLY matched?
(A) Soybean - Solanine
(B) Castor bean - Ricin
(C) Potato - Bowman-Birk inhibitor
(D) Wheat - Phytohaemagglutinin

44. A Food Safety Officer investigates an outbreak of gastrointestinal distress linked to a local community kitchen. The implicated food is a raw green bean and lentil sprout salad. Laboratory analysis shows high levels of a protein that aggressively binds to the intestinal mucosa and resists pepsin digestion. Based on the pathogenesis, which specific toxicant should the FSO flag?
(A) Tannins
(B) Lectins
(C) Oxalates
(D) Glucosinolates

45. An engineer is validating the performance of a new continuous steam desolventizer-toaster (DT) used in a soybean oil extraction plant. To ensure the resulting soybean meal is safe for monogastric animal consumption, which parameter should be routinely assayed as a key performance indicator of the heat treatment?
(A) Residual trypsin inhibitor activity
(B) Residual phytic acid concentration
(C) Total saponin content of the meal
(D) Endogenous lipase activity of seeds

46. Glucosinolates are biologically inactive themselves but yield toxic products upon hydrolysis. Which endogenous plant enzyme is responsible for catalyzing this hydrolysis?
(A) Lipoxygenase
(B) Phytase
(C) Myrosinase
(D) Polyphenol oxidase

47. Match the classes of goitrogenic compounds in List I with their specific physiological mechanism in List II.
List I: (Goitrogenic Compounds)
P. Thiocyanates
Q. Oxazolidine-2-thiones (e.g., Goitrin)
R. Isothiocyanates

Click Here to Buy book on Amazon

S. Glucosinolates

List II: (Physiological Mechanisms)

I. Intact parent compounds stored in plant vacuoles

II. Competitively inhibit iodine uptake by the thyroid gland

III. Irreversibly interfere with thyroid hormone synthesis (organification of iodine)

IV. Volatile compounds contributing to the pungent flavor of mustard

(A) P-II, Q-III, R-IV, S-I

(B) P-III, Q-II, R-I, S-IV

(C) P-II, Q-IV, R-III, S-I

(D) P-IV, Q-I, R-II, S-III

48. Which of the following statements correctly explains the action of oxazolidine-2-thiones (like goitrin) on human metabolism?

(A) They act as powerful chelating agents for dietary zinc.

(B) They competitively bind to the sodium-iodide symporter (NIS), preventing iodine transport into the thyroid.

(C) They inhibit the enzyme thyroid peroxidase, blocking the incorporation of iodine into thyroglobulin.

(D) They destroy the pancreatic beta cells, preventing insulin secretion.

49. Saponins in foods are best defined as:

(A) Highly cross-linked glycoprotein molecules found almost exclusively in animal connective tissues.

(B) Amphiphilic glycosides composed of a lipid-soluble aglycone and water-soluble sugar chains.

(C) Volatile organosulfur compounds responsible primarily for the tear-inducing effect of raw onions.

(D) Heat-stable alkaloids that selectively inhibit acetylcholine release at neuromuscular junctions.

50. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).

Assertion (A): Saponins possess potent haemolytic activity when injected intravenously but are generally not toxic when ingested orally.

Reason (R): Saponins undergo rapid enzymatic degradation by salivary amylase, destroying their amphiphilic structure before they reach the bloodstream.

(A) Both (A) and (R) are true and (R) is the correct explanation of (A).

(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).

(C) (A) is true but (R) is false.

(D) (A) is false but (R) is true.

NODIA

51. Which of the following plant families is NOT characteristically known as a major source of goitrogenic glucosinolates?

(A) Fabaceae (e.g., Soybeans, Lentils)

(B) Brassicaceae (e.g., Cabbage, Broccoli)

(C) Cruciferae (e.g., Mustard, Radish)

(D) Cleomaceae (e.g., Spider weed)

52. Consider the physical and chemical properties of dietary saponins:

I. They lower the surface tension of aqueous solutions, creating stable foams.

II. They form insoluble complexes with dietary cholesterol in the gut.

III. They are highly susceptible to destruction by standard domestic boiling.

IV. They impart a strong bitter taste to foods like quinoa.

Which of these properties are correct?

(A) I, II, and IV only

(B) I, III, and IV only

(C) II, III, and IV only

(D) I, II, and III only

53. Given below are two statements:

Statement I: The hydrolysis of glucosinolates by myrosinase always produces thiocyanates, regardless of the pH or the specific glucosinolate structure.

Statement II: The action of myrosinase requires physical compartmentalization breakdown, typically achieved by chewing, crushing, or processing the plant tissue.

(A) Both Statement I and Statement II are true.

(B) Both Statement I and Statement II are false.

(C) Statement I is true but Statement II is false.

(D) Statement I is false but Statement II is true.

54. A community relies heavily on unfermented cassava and raw cabbage as staple foods, with marginal dietary iodine intake. Over time, an unusually high incidence of goiter is observed. This epidemiological finding is primarily an application of the concept that:

(A) High fiber diets from cabbage accelerate systemic iodine excretion through the feces.

(B) Polyphenolic tannins from cabbage

irreversibly bind dietary iodine in the upper digestive tract.

(C) Cassava consumption upregulates the biological synthesis of thyroid-stimulating hormone directly.

(D) Thiocyanates derived from cyanogens and glucosinolates competitively block thyroid iodine uptake.

55. Which of the following statements about saponins is INCORRECT?

(A) The aglycone portion of a saponin is known as a sapogenin.

(B) Saponins act as powerful protease inhibitors in the duodenum.

(C) Saponins can increase the permeability of intestinal mucosal cells.

(D) Washing quinoa grains in cold water effectively reduces their saponin content.

56. To safely process rapeseed into a non-goitrogenic edible meal for livestock, which of the following is the MOST EFFECTIVE method to prevent the formation of toxic goitrogens?

(A) Wetting seeds to activate endogenous myrosinase prior to cold pressing and oil extraction.

(B) Fermenting the crushed seeds with wild yeast strains under anaerobic conditions for 48 hours.

(C) Subjecting the intact seeds to rapid thermal inactivation to destroy myrosinase before crushing.

(D) Extracting seeds with non-polar organic solvents like hexane to remove glucosinolates.

57. The hypocholesterolemic effect observed after dietary intake of foods rich in saponins is primarily caused by:

(A) Saponins directly inhibiting the regulatory HMG-CoA reductase enzyme pathways in liver cells.

(B) Saponins upregulating the cellular expression of functional LDL receptors on healthy hepatocytes.

(C) Saponins biochemically oxidizing dietary cholesterol molecules into harmless inactive phytosterols.

(D) Saponins binding with cholesterol and bile acids in the gut, forming mixed micelles that are excreted.

NODIA

58. Which of the following pairs concerning saponin properties is INCORRECTLY matched?

(A) Taste profile - Sweet and umami

(B) Aglycone structure - Triterpenoid or Steroid

(C) Physical property - Surfactant and foaming agent

(D) Biological effect - Haemolysis in vitro

59. A food processing startup is scaling up a quinoa-based beverage. During pilot trials, the beverage consistently exhibits a persistent, unwanted foam and a distinctly bitter aftertaste. The FSO auditing the facility notes the raw quinoa was only dry-milled. What corrective processing step should the FSO recommend to resolve the toxicological and sensory issue?

(A) Implementing an intense high-temperature roasting step at 200°C prior to the milling process.

(B) Incorporating an abrasive polishing or aqueous washing step to remove the outer seed coat pericarp.

(C) Adding specialized exogenous proteases during formulating to completely hydrolyze the bitter peptides.

(D) Adjusting the physical pH of the beverage to 2.0 to precipitate the bitter-tasting active compounds.

60. An FSO is reviewing the safety dossier of a new mustard paste product. The manufacturer claims their product retains the sharp, pungent flavor of mustard but is entirely free of goitrogenic activity. As a competent authority, the FSO should evaluate this claim knowing that:

(A) Mustard pungency is caused primarily by the alkaloid capsaicin, which has no biochemical relationship to goitrogenic compounds.

(B) The pungency of mustard is derived from allyl isothiocyanate, which is inherently a product of glucosinolate hydrolysis.

(C) Goitrogenic activity only occurs after the plant's endogenous myrosinase enzymes are completely denatured by high heat.

(D) Glucosinolates naturally evaporate into the atmosphere during the high-speed mechanical crushing of raw mustard seeds.

61. Which specific cyanogenic glycoside is predominantly found in cassava roots (Manihot esculenta)?

(A) Linamarin

(B) Amygdalin

(C) Dhurrin
(D) Prunasin

62. Match the cyanogenic glycosides in List I with their primary plant sources in List II.
List I: (Cyanogenic Glycosides)
P. Amygdalin
Q. Dhurrin
R. Linamarin
S. Prunasin
List II: (Primary Plant Sources)
I. Sorghum
II. Bitter almonds and apricot kernels
III. Cassava and lima beans
IV. Wild cherry bark
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-IV, R-I, S-II
(D) P-II, Q-III, R-IV, S-I

63. Which of the following statements correctly details the mechanism of cyanide release from cyanogenic plants?
(A) The plant tissue naturally respires gaseous hydrogen cyanide as a metabolic byproduct during standard photosynthesis.
(B) High cooking temperatures directly catalyze the rapid, spontaneous chemical breakdown of glycosides into cyanide gas.
(C) Acidic stomach secretions uniquely transform the inert raw plant matrix into volatile and highly toxic hydrogen cyanide.
(D) Cyanogenic glycosides are hydrolyzed by endogenous beta-glucosidases when cellular compartmentalization is disrupted.

64. Alkaloids in food plants are best defined as:
(A) Complex carbohydrate polymers that resist enzymatic digestion and function primarily as dietary fiber in the human gut.
(B) Volatile organic acids and esters that are responsible for producing the distinct, pleasant aroma of ripening fruits.
(C) Nitrogen-containing, naturally occurring organic compounds that often have significant pharmacological or toxic effects.
(D) Synthetic organophosphate chemicals used by commercial agricultural operations exclusively as pre-harvest pesticides.

65. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): Inadequately processed bitter cassava consumption is strongly associated with the neurological disease konzo.
Reason (R): The residual hydrogen cyanide ingested from bitter cassava metabolizes into thiocyanate, depleting sulfur-containing amino acids and causing neurotoxicity.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

66. Which of the following commonly consumed plants is generally NOT recognized as a source of cyanogenic glycosides?
(A) Lima beans
(B) Bamboo shoots
(C) Apple seeds
(D) Spinach

67. Consider the following statements about solanine, a glycoalkaloid found in potatoes:
I. It is concentrated primarily in the skin and green parts of the potato tuber.
II. It functions as a potent inhibitor of the enzyme acetylcholinesterase.
III. It is easily and completely destroyed by standard domestic boiling or baking.
IV. Its synthesis in potatoes is stimulated by exposure to light.
(A) I, II, and III only
(B) I, II, and IV only
(C) II, III, and IV only
(D) I, III, and IV only

68. Given below are two statements:
Statement I: The complete enzymatic degradation of amygdalin yields hydrogen cyanide, benzaldehyde, and glucose.
Statement II: Hydroxynitrile lyase is the enzyme responsible for the final step of breaking down cyanohydrins into hydrogen cyanide and a ketone/aldehyde.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

69. A consumer stores a large batch of potatoes in a well-lit, warm area for several weeks. The tubers develop a distinct green color. If these potatoes

Downloaded from www.pdf.tube

are consumed after boiling, what is the most likely physiological consequence?
(A) Gastrointestinal distress and neurological symptoms due to heat-stable glycoalkaloids.
(B) Severe nutritional zinc deficiency in consumers due to heightened phytate synthesis.
(C) Acute cyanide poisoning resulting from the activation of endogenous beta-glucosidases.
(D) No physiological effect, as boiling completely neutralizes the chlorophyll-associated toxins.

70. Which of the following statements regarding toxic plant alkaloids is INCORRECT?
(A) Pyrrolizidine alkaloids, found in certain weeds that may contaminate grain crops, are highly hepatotoxic.
(B) Tropane alkaloids, such as atropine from Datura stramonium, act as anticholinergic agents.
(C) Solanine and chaconine account for the majority of glycoalkaloids in Solanum tuberosum.
(D) Glycoalkaloids in tomatoes (tomatine) are most concentrated in the fully ripe, red fruit.

71. Arrange the biochemical steps of cyanogenesis in the correct sequential order:
I. Spontaneous or enzyme-catalyzed dissociation of an intermediate to release Hydrogen Cyanide (HCN)
II. Tissue damage bringing the substrate and enzyme into contact
III. Hydrolysis of the cyanogenic glycoside by beta-glucosidase
IV. Formation of a cyanohydrin intermediate
(A) II, III, IV, I
(B) II, IV, III, I
(C) III, II, IV, I
(D) III, IV, II, I

72. At the cellular level, the acute lethal toxicity of hydrogen cyanide is primarily an effect of:
(A) Its irreversible binding to blood hemoglobin molecules, which completely blocks systemic oxygen transport in the body.
(B) Its rapid and uncontrolled induction of massive lipid peroxidation events across the primary cell membrane structures.
(C) Its binding to the ferric iron in cytochrome c oxidase, abruptly halting the mitochondrial electron transport chain.
(D) Its highly specific competitive inhibition of cellular DNA polymerase enzymes, completely ceasing active replication.

73. Which of the following pairs of toxic phytochemical and its physiological effect is CORRECTLY matched?
(A) Solanine - Disruption of mitochondrial electron transport
(B) Amygdalin - Inhibition of acetylcholinesterase
(C) Gossypol - Hypertrophy of the thyroid gland
(D) Pyrrolizidine alkaloids - Veno-occlusive liver disease

74. An FSO responds to an emergency at a bakery where several workers collapsed after consuming a massive quantity of raw paste made from bitter almonds. The FSO immediately recognizes the signs of acute cyanide poisoning. What specific aroma in the breath of the victims or the paste itself would support this preliminary finding?
(A) Bitter almonds (Benzaldehyde)
(B) Rotten eggs (Hydrogen sulfide)
(C) Garlic (Allicin)
(D) Vinegar (Acetic acid)

75. An FSO is responsible for setting critical limits in a standard operating procedure for tapioca starch production to ensure safety from cyanogenic glycosides. The most crucial operational step to ensure the removal of HCN is:
(A) Treating the intact roots with high-concentration sulfur dioxide prior to peeling.
(B) Grating/rasping the roots followed by extensive water washing and pressing.
(C) Prolonged storage of the harvested roots at high humidity to promote natural aging.
(D) Deep-frying the whole roots prior to starch extraction.

NODIA

76. The simple domestic practice of soaking legumes in water for 12 hours prior to cooking reduces anti-nutritional factors primarily through which mechanism?
(A) Promoting the extensive covalent cross-linking of structural proteins to entrap the anti-nutritional compounds.
(B) Leaching water-soluble ANFs like tannins, phytates, and soluble oxalates into the discardable soak water.
(C) Rapid physical denaturation of active protease inhibitors caused by the high osmotic pressure of pure water.
(D) Accelerating the spontaneous chemical

conversion of cyanogenic glycosides into harmless simple sugar molecules.

77. Match the Enzyme Commission (EC) classifications in List I with their defining reactions in List II.
List I: (Enzyme Commission Classifications)
P. Oxidoreductases (EC 1)
Q. Hydrolases (EC 3)
R. Lyases (EC 4)
S. Isomerases (EC 5)
List II: (Defining Reactions)
I. Cleavage of bonds by the addition of water
II. Catalyze oxidation-reduction reactions
III. Cleavage of C-C, C-O, or C-N bonds by means other than hydrolysis or oxidation
IV. Catalyze structural shifts within a single molecule
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-III, R-I, S-IV
(D) P-III, Q-I, R-II, S-IV

78. Which of the following statements correctly describes the effect of traditional sourdough fermentation on the nutritional quality of bread?
(A) It increases the total phytic acid content of the crumb, significantly enhancing the overall mold-free shelf life of the bread.
(B) Fermentation actively synthesizes novel denatured tannins which directly improve the functional protein quality of the crust.
(C) Lactic acid bakeries lower the dough pH, optimizing the activity of endogenous flour phytases which degrade phytic acid.
(D) Yeast anaerobic metabolism produces highly competitive enzymatic inhibitors that completely block active starch hydrolysis.

79. According to the International Union of Biochemistry (IUB) classification, oxidoreductases are defined as enzymes that:
(A) Catalyze the chemical transfer of functional groups like methyl or phosphate groups between distinct molecules.
(B) Join two separate organic molecules together through a reaction coupled directly with the input of cellular ATP.
(C) Hydrolyze ester bonds in hydrophobic lipid molecules to release free fatty acids and alcohol backbones.
(D) Catalyze the direct transfer of electrons from one molecule (the reductant) to another (the oxidant).

80. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): The germination (malting) of cereal grains significantly enhances the bioavailability of essential minerals and the digestibility of starches and proteins.
Reason (R): Germination initiates the de novo synthesis and activation of endogenous enzymes such as phytases, amylases, and proteases.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

81. Which of the following is NOT an expected biochemical outcome of the germination (sprouting) of legumes?
(A) Reduction in phytic acid levels
(B) Accumulation of high molecular weight starch polymers
(C) Increase in vitamin C content
(D) Decrease in the concentration of alpha-galactosides (e.g., stachyose, raffinose)

82. Consider the thermal stability of various anti-nutritional factors:
I. Bowman-Birk inhibitors are relatively heat-stable compared to Kunitz inhibitors.
II. Phytic acid is highly heat-labile and is destroyed by boiling for 5 minutes.
III. Phytohaemagglutinins are inactivated by adequate wet heating (e.g., pressure cooking).
IV. Tannins are completely denatured and lose their protein-binding capacity upon mild pasteurization.
Which of the statements are correct?
(A) I and III only
(B) II and IV only
(C) I, II, and III only
(D) I, III, and IV only

83. Given below are two statements:
Statement I: Enzymes exhibit high specificity for their substrates, allowing for targeted biochemical modifications in food processing without generating unwanted byproducts.
Statement II: The lock-and-key model suggests that the enzyme's active site undergoes

Click Here to Buy book on Amazon

significant conformational changes to bind any available substrate in the food matrix.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

84. The production of tempeh, a traditional Indonesian fermented food, involves the mold Rhizopus oligosporus growing on soybeans. This fungal fermentation applies the concept of biological detoxification primarily by:
(A) Synthesizing volatile fatty acids that actively vaporize trypsin inhibitors during solid-state fermentation.
(B) Upregulating the metabolic synthesis of complex lectins to outcompete and inhibit common spoilage bacteria.
(C) Secreting extracellular proteases and phytases to degrade anti-nutritional factors and improve bioavailability.
(D) Forming an impenetrable physical barrier that prevents humans from digesting and absorbing raw soy proteins.

85. Which of the following statements regarding enzyme kinetics in food processing is INCORRECT?
(A) Enzymes alter the equilibrium constant of a chemical reaction, forcing incomplete reactions to completion.
(B) Enzyme activity generally increases with temperature up to a specific optimum, beyond which denaturation occurs.
(C) The Michaelis constant (K_m) represents the substrate concentration at which the reaction rate is half of its maximum (V_{max}).
(D) Extreme pH levels can reversibly or irreversibly inactivate food enzymes by altering the ionization state of their active site amino acids.

86. For a food processor aiming to efficiently and simultaneously reduce the levels of multiple heat-labile ANFs (such as protease inhibitors and lectins) in bulk legume flours, the MOST APPROPRIATE generalized industrial technique is:
(A) Cold atmospheric plasma treatment
(B) Freeze-drying
(C) Ultraviolet (UV-C) irradiation
(D) Extrusion cooking

87. The observed reduction of phytic acid during the lactic acid fermentation of cereal gruels is a direct effect of:
(A) Lactic acid bacteria actively metabolizing complex phytic acid molecules as their sole metabolic carbon source.
(B) Organic acid production lowering the pH to the optimal range for endogenous cereal phytase activity.
(C) The rapid biological synthesis of bacteriocins that competitively bind to the negative myo-inositol ring.
(D) The continuous physical agitation of the fermentation process mechanically breaking down the phytate structure.

88. Which of the following pairs of ANF removal methods and their primary target mechanism is INCORRECTLY matched?
(A) Roasting - Thermal destruction of heat-labile proteins
(B) Fermentation - Enzymatic degradation by microbial or activated endogenous enzymes
(C) Soaking - Volatilization of complex carbohydrates into gases
(D) Milling/Debranning - Physical removal of ANFs concentrated in the outer seed coat

89. A food engineer is designing a processing line for a composite flour made from sorghum, soybeans, and cassava. The safety dossier demands minimal residual cyanogens, minimized trypsin inhibitors, and low tannin levels. Which sequence of processing steps best addresses all three concerns?
(A) Dry milling all three crops together followed immediately by direct packaging and sealing of the flour.
(B) Boiling whole sorghum grains → Dry milling raw soybeans → Sun-drying bitter cassava roots → Final blending.
(C) Fermenting intact soybeans → Dry milling peeled cassava roots → Intense roasting of sorghum grains → Blending.
(D) Rasping and wet-pressing cassava → Roasting/Extruding soybeans → Debranning sorghum → Final blending.

NODIA

90. An FSO is reviewing the validation parameters of a soybean toaster. The D-value (decimal reduction time) for the trypsin inhibitor at 110°C is determined to be 4 minutes. If the initial trypsin inhibitor content must be reduced

by 99.9% to meet safety regulations, what is the minimum required holding time at 110°C?
(A) 4 minutes
(B) 8 minutes
(C) 12 minutes
(D) 16 minutes

91. Which of the following amylases acts as an endo-enzyme, randomly cleaving alpha-1,4-glycosidic bonds within the starch molecule to produce dextrins?
(A) Beta-amylase
(B) Alpha-amylase
(C) Glucoamylase
(D) Pullulanase

92. Match the Food-Grade Proteases in List I with their Primary Biological Origin in List II.
List I: (Food-Grade Proteases)
P. Papain
Q. Bromelain
R. Ficin
S. Chymosin (Rennet)
List II: (Primary Biological Origin)
I. Calf stomach (abomasum)
II. Fig latex
III. Pineapple stem/fruit
IV. Papaya latex
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-II, R-III, S-I
(D) P-I, Q-III, R-II, S-IV

93. Which of the following statements correctly describes the action of beta-amylase in food processing?
(A) It is an exo-enzyme that cleaves successive maltose units from the non-reducing end of the starch chain.
(B) It hydrolyzes alpha-1,6-glycosidic bonds in amylopectin, completely debranching the starch.
(C) It acts exclusively on cellulose to produce free glucose molecules.
(D) It randomly cleaves alpha-1,4-glycosidic bonds, causing a rapid decrease in the viscosity of starch pastes.

94. Chymosin, the active enzyme in traditional rennet, is best defined biochemically as:
(A) A lipolytic enzyme that cleaves short-chain fatty acids from triglycerides.
(B) A serine protease responsible for the extensive breakdown of myofibrillar proteins in meat.
(C) An aspartic acid protease that specifically cleaves the Phe105-Met106 bond in kappa-casein.
(D) An oxidoreductase that catalyzes the cross-linking of casein micelles.

95. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): The supplementation of alpha-amylase in bread dough formulations significantly retards the staling rate of the baked bread.
Reason (R): Alpha-amylase hydrolyzes starch into smaller dextrins that interfere with the retrogradation and recrystallization of amylopectin during storage.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

96. Which of the following enzymes is NOT commercially utilized for the tenderisation of meat?
(A) Papain from papaya latex
(B) Bromelain from pineapple
(C) Pectin methylesterase
(D) Ficin from fig latex

97. Consider the role of exogenous and endogenous proteases in cheese ripening:
I. They hydrolyze caseins into smaller peptides and free amino acids, contributing to cheese flavor.
II. Excessive proteolytic activity can lead to a bitter defect in the cheese.
III. They are entirely inactivated by the pasteurization of milk before cheese making.
IV. They are responsible for breaking down lactose into lactic acid.
Which of the statements are correct?
(A) I and II only
(B) I, II, and III only
(C) II and IV only
(D) I, III, and IV only

98. Given below are two statements:
Statement I: Amyloglucosidase (glucoamylase) is an exo-acting enzyme capable of hydrolyzing both alpha-1,4 and alpha-1,6 glycosidic bonds,

Downloaded from www.pdf.tube

yielding monomeric glucose.
Statement II: Amyloglucosidase is exclusively sourced from animal pancreas for use in the high-fructose corn syrup industry.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

99. A meat processor applies a high concentration of bromelain to a batch of beef steaks and leaves them to marinate for 24 hours at room temperature. The most predictable application outcome of this concept is:
(A) The meat texture will become excessively mushy and pasty due to profound proteolysis.
(B) The meat will become perfectly tenderized with optimal juicy texture ideal for high-heat grilling.
(C) The meat will undergo severe and rapid enzymatic browning across all exposed muscle surfaces.
(D) The meat will become entirely sterile, completely eliminating the need for subsequent cooking.

100. Which of the following statements regarding fungal amylases used in baking is INCORRECT?
(A) Fungal alpha-amylases have a lower thermal denaturation temperature compared to bacterial alpha-amylases.
(B) Fungal amylases are preferred in breadmaking because they are inactivated early during baking, preventing excessive stickiness.
(C) Fungal amylases survive the entire baking process and continue to break down starch during bread storage.
(D) They are commonly sourced from Aspergillus oryzae.

101. Arrange the primary enzymatic steps used in the commercial production of high-fructose corn syrup (HFCS) from corn starch in the correct sequential order:
I. Saccharification by Glucoamylase
II. Liquefaction by thermostable Alpha-amylase
III. Isomerization by Glucose isomerase
(A) II, I, III
(B) I, II, III
(C) III, II, I
(D) II, III, I

102. The rich umami flavor developed during the long-term fermentation of soy sauce is the direct physiological effect of:
(A) Thermal caramelization of soy sugars and wheat starches during high-temperature roasting.
(B) Lipolytic breakdown of soy lipids into free fatty acids by endogenous lipase enzymes.
(C) Enzymatic oxidation of native polyphenols by fungal laccase enzymes during the aging phase.
(D) Proteolytic action of Aspergillus oryzae proteases releasing abundant free glutamic acid.

103. Which of the following pairs of protease and its primary commercial application is CORRECTLY matched?
(A) Bromelain - Clarification and viscosity reduction of raw apple juice
(B) Papain - Chill-proofing of beer to prevent protein-polyphenol haze
(C) Rennet - Enzymatic tenderization of tough structural cuts of beef
(D) Trypsin - Rapid coagulation of bovine milk for cheddar cheese making

NODIA

104. An FSO is reviewing customer complaints about a particular brand of sliced bread that consistently feels "gummy" and collapses in the center, despite being fully baked. The bakery uses a bacterial alpha-amylase as an additive. What technical case assessment is most accurate?
(A) Under-dosing the bacterial amylase caused incomplete gelatinization, leading to starch starvation and crumb collapse.
(B) The active amylase directly degraded the structural gluten network of the dough, causing severe structural collapse.
(C) Bacterial alpha-amylase is highly thermostable, surviving the baking process and over-hydrolyzing the starch backbone during cooling.
(D) The amylase actively converted all the functional flour lipids into soapy fatty acids that disrupted gas retention.

105. A food technologist is formulating a shelf-stable cake. To delay staling via anti-firming properties without causing structural collapse of the crumb, which specific enzyme application is scientifically competent to select?
(A) High dose of highly thermostable bacterial

alpha-amylase that continues acting during cooling
(B) Pectin methylesterase, to cross-link the carbohydrate crumb structure of the baked cake
(C) Pepsin, to actively digest and break down the structural gluten network immediately
(D) Maltogenic amylase, which trims maltose from starch and is moderately heat-labile

106. The primary biochemical function of food-grade lipases is to:
(A) Hydrolyze ester bonds in triglycerides to release fatty acids, diacylglycerols, and monoacylglycerols.
(B) Catalyze the enzymatic oxidation of unsaturated fatty acids to form highly reactive lipid hydroperoxides.
(C) Convert natural cis-double bonds in unsaturated fatty acids to industrial trans-double bond structures.
(D) Polymerize short-chain volatile fatty acids into long-chain saturated fats during prolonged storage.

107. Match the Pectic Enzymes in List I with their Mode of Action in List II.
List I: (Pectic Enzymes)
P. Pectin methylesterase (PME)
Q. Polygalacturonase (PG)
R. Pectin lyase (PL)
List II: (Mode of Action)
I. Cleaves the alpha-1,4-glycosidic bonds by beta-elimination, resulting in an unsaturated double bond
II. Hydrolyzes the methyl ester groups from pectin, yielding pectic acid and methanol
III. Hydrolyzes the alpha-1,4-glycosidic bonds in the polygalacturonic acid backbone
(A) P-II, Q-III, R-I
(B) P-III, Q-II, R-I
(C) P-II, Q-I, R-III
(D) P-I, Q-III, R-II

108. Which of the following statements correctly highlights the role of lipases in the dairy industry?
(A) Lipases are added to pasteurized fluid milk to prevent the physical formation of undesirable cream lines during storage.
(B) Exogenous lipases, such as those from calf prestomach or microbial sources, are essential for developing the characteristic piquant flavor of Romano, Provolone, and Blue cheeses.
(C) Lipases are applied during butter processing to selectively target and completely remove cholesterol molecules.
(D) Lipases degrade the outer hydrophilic layer of casein micelles, initiating the rapid clotting of milk.

109. Cellulases used in food processing are best defined as:
(A) Enzymes (endoglucanases, exoglucanases, cellobiases) that synergistically hydrolyze beta-1,4-bonds in cellulose.
(B) Synthetic enzymes that produce cellulose microfibrils to physically thicken fruit juices during commercial processing.
(C) Specialized proteases that specifically target and degrade structural cell wall proteins of common spoilage bacteria.
(D) Polysaccharide lyases that are utilized to extract highly functional pectin molecules from waste citrus peels.

110. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): In the production of unclarified citrus juices (like orange juice), maintaining the suspension of "cloud" particles is highly desirable, and pasteurization is critical for this.
Reason (R): Pasteurization rapidly inactivates endogenous Pectin methylesterase (PME), which would otherwise de-esterify pectin, leading to calcium-bridging and the precipitation of the cloud.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

111. Which of the following is NOT a recognized application or consequence of lipase activity in food?
(A) Production of characteristic flavors in certain aged cheeses
(B) Enzymatic interesterification of fats to produce cocoa butter equivalents
(C) Induction of hydrolytic rancidity in poorly stored nuts and unrefined oils
(D) Catalyzing the Maillard browning reaction in baked goods

Click Here to Buy book on Amazon

112. Consider the application of pectinases in the fruit juice industry:
I. They are used to increase the juice yield during pressing.
II. They aid in the complete clarification of apple juice by breaking down the pectin network holding suspended particles.
III. They are used to increase the viscosity of tomato ketchup.
IV. They are often used in combination with cellulases for macerating fruit pulp.
Which of the statements are correct?
(A) I, II, and III only
(B) I, II, and IV only
(C) II, III, and IV only
(D) I, III, and IV only

113. Given below are two statements:
Statement I: Hydrolytic rancidity in dairy products is caused by the release of short-chain free fatty acids, such as butyric acid, due to lipase action.
Statement II: Hydrolytic rancidity poses a severe toxicological threat and requires immediate product recall due to acute hepatotoxicity.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

114. A juice manufacturer wants to extract maximum juice and pigments from red grapes during processing. The application of a specific enzyme complex results in significant breakdown of the plant cell walls and increased extractability. This applied concept primarily relies on the action of:
(A) Alpha-amylase and glucoamylase
(B) Lipases and esterases
(C) Papain and bromelain
(D) Cellulases and pectinases

115. Which of the following statements about pectin lyase (PL) action is INCORRECT?
(A) It requires pectin to be completely de-esterified into pectic acid before it can act.
(B) It cleaves the pectin polymer without introducing a water molecule.
(C) Its action creates a double bond at the non-reducing end of the generated product.
(D) It is an endo-acting enzyme that rapidly reduces the viscosity of highly esterified pectin solutions.

116. To prevent the development of a "soapy" or "rancid" off-flavor in stored butter resulting from enzymatic action, which of the following is the MOST APPROPRIATE industrial practice?
(A) Incorporating high levels of synthetic antioxidants like BHA or BHT.
(B) Adding exogenous pectin methylesterase to stabilize the fat emulsion.
(C) Ensuring rigorous pasteurization of the cream to completely inactivate endogenous milk lipases.
(D) Storing the butter at room temperature to allow beneficial bacteria to outcompete lipolytic molds.

117. During the commercial clarification of apple juice, the addition of polygalacturonase directly leads to:
(A) A sharp decrease in juice viscosity by hydrolyzing the pectin backbone.
(B) An increase in juice turbidity from enzymatic protein precipitation.
(C) The rapid biological synthesis of volatile ester flavor compounds.
(D) The oxidation of natural polyphenols, turning the apple juice black.

118. Which of the following pairs linking an enzyme to the specific quality defect it causes if left uncontrolled is INCORRECTLY matched?
(A) Lipoxygenase - Bleaching of natural flour pigments
(B) Pectin methylesterase - Loss of cloud in orange juice
(C) Lipase - Hydrolytic rancidity in raw milk
(D) Cellulase - Enzymatic browning in cut apples

119. An FSO inspects a small-scale artisan dairy producing raw-milk cheese. Several batches of aged cheese have developed an overwhelmingly pungent, soapy flavor, leading to consumer rejection. Lab results show high levels of capric and caproic free fatty acids. The FSO correctly deduces the case is due to:
(A) Contamination of the cheese batch with pathogenic strains of E. coli during production.
(B) Uncontrolled action of native milk lipases or psychrotrophic bacterial lipases.
(C) Excessive rennet enzyme addition leading directly to hydrophobic bitter peptide formation.
(D) Rapid chemical oxidation of the cheese curd

Downloaded from www.pdf.tube

surface catalyzed by active airborne laccases.

120. An extraction engineer aims to improve the yield of high-quality, cold-pressed extra virgin olive oil without utilizing heat or chemical solvents. Which biologically competent intervention should the engineer select?
(A) Adding high doses of chemical sodium hydroxide to completely saponify lipids prior to mechanical extraction.
(B) Treating the olive paste with active polyphenol oxidase enzymes to artificially darken the oil's final color.
(C) Pretreating the olive paste with pectinases and cellulases to break down the malaxation emulsion.
(D) Immersing the whole olives in a bath of active alpha-amylase for forty-eight hours prior to pressing.

121. Polyphenol oxidase (PPO) catalyzes the oxidation of endogenous phenolic compounds into:
(A) Flavonols
(B) Anthocyanins
(C) Tannins
(D) Quinones

122. Match the Enzyme Immobilisation Techniques in List I with their Fundamental Mechanism in List II.
List I: (Enzyme Immobilisation Techniques)
P. Adsorption
Q. Covalent binding
R. Entrapment
S. Cross-linking
List II: (Fundamental Mechanism)
I. Physical inclusion of the enzyme within a porous gel matrix (e.g., calcium alginate)
II. Chemical bonding of the enzyme to a solid support matrix via functional groups
III. Weak, reversible interactions (van der Waals, hydrogen bonds) with a carrier surface
IV. Intermolecular chemical bonding of enzyme molecules to each other using a bifunctional reagent (e.g., glutaraldehyde)
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-III, R-I, S-IV
(C) P-III, Q-I, R-II, S-IV
(D) P-I, Q-II, R-IV, S-III

123. Which of the following statements correctly explains a beneficial role of Lipoxygenase (LOX) in wheat flour dough processing?
(A) It catalyzes the complete chemical hydrolysis of gluten, making the dough highly extensible and easy to mold.
(B) It co-oxidizes carotenoid pigments, resulting in the desirable bleaching of the bread crumb.
(C) It biochemically synthesizes trans-fatty acids which act as excellent dough conditioners during proofing.
(D) It rapidly produces dark melanin pigments that give a highly desirable deep brown crust to the baked bread.

124. Enzyme immobilisation in food biotechnology is best defined as:
(A) The complete and irreversible thermal denaturation of active enzymes to prevent enzymatic food spoilage.
(B) Confining an enzyme to a solid support for continuous use and easy recovery from the product.
(C) Modifying an enzyme's genetic sequence to permanently prevent it from translocating within the cell.
(D) Adding heavy metals to a food matrix to competitively inhibit and block active sites of local enzymes.

125. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): Blanching vegetables before freezing is an essential critical control point in frozen food processing.
Reason (R): Blanching subjects the vegetables to a short, mild heat treatment that inactivates enzymes like lipoxygenase and peroxidase, which would otherwise cause off-flavors and color loss during frozen storage.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

126. Which of the following is NOT an established method for the immobilisation of enzymes used in industrial food applications?
(A) Entrapment in a polymeric gel matrix
(B) Covalent attachment to a functionalized

NODIA

inert support
(C) Homogenization in an aqueous buffer
(D) Cross-linking with glutaraldehyde

127. Consider the reaction mechanism and consequences of Polyphenol oxidase (PPO) in foods:
I. PPO catalyzes the hydroxylation of monophenols to o-diphenols.
II. PPO catalyzes the oxidation of o-diphenols to o-quinones.
III. The generated quinones are highly reactive and spontaneously polymerize to form dark melanin pigments.
IV. PPO activity is completely dependent on the presence of the copper cofactor.
Which of the statements are correct?
(A) I and II only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, III, and IV

128. Given below are two statements:
Statement I: The action of lipoxygenase (LOX) on polyunsaturated fatty acids produces hydroperoxides, which can break down into volatile aldehydes and ketones causing "beany" or rancid off-flavors in soy products.
Statement II: LOX activity is completely inhibited by exposure to atmospheric oxygen.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

129. A processor of dried apricots uses a sulfur dioxide (SO2) treatment prior to drying. The fundamental biochemical concept behind this application is that SO2:
(A) Acts as an active competitive substrate for lipoxygenase enzymes to enhance fruit color.
(B) Converts quinones back to diphenols and directly inhibits polyphenol oxidase.
(C) Hydrolyzes structural plant cell walls, significantly accelerating the raw fruit drying process.
(D) Irreversibly binds to insoluble dietary fiber, improving the final mouthfeel and texture.

130. Which of the following statements regarding the industrial use of immobilised glucose isomerase is INCORRECT?
(A) It is the most widely utilized immobilised enzyme in the food industry.
(B) It catalyzes the reversible conversion of D-glucose to D-fructose.
(C) The use of immobilised glucose isomerase allows for continuous column operation in the production of High-Fructose Corn Syrup (HFCS).
(D) Immobilisation renders the enzyme heat-labile, meaning it can only operate at refrigeration temperatures.

131. Arrange the sequential biochemical steps involved in the enzymatic browning of plant tissues:
I. Polymerization of reactive intermediates to form dark insoluble melanins
II. Oxidation of o-diphenols to o-quinones by PPO
III. Hydroxylation of monophenols to o-diphenols by PPO
IV. Spontaneous reaction of o-quinones with amino acids or other quinones
(A) III, II, IV, I
(B) II, III, I, IV
(C) III, IV, II, I
(D) II, I, IV, III

132. The primary technical effect of covalently binding an industrial enzyme to an inorganic silica support matrix is often:
(A) A dramatic and rapid increase in the enzyme's solubility within the final liquid food product.
(B) The rapid auto-digestion and breakdown of the structural enzyme molecule during active processing.
(C) Enhancing thermal and operational stability, allowing continuous processing at higher temperatures.
(D) A complete and permanent shift in the enzyme's substrate specificity from proteins to carbohydrates.

133. Which of the following pairs of browning control methods and their underlying mechanism is CORRECTLY matched?
(A) Citric acid addition - Lowering pH below the optimum for PPO activity
(B) Ascorbic acid addition - Chelation of the copper cofactor of PPO
(C) Blanching treatment - Reversible competitive inhibition of active PPO
(D) Vacuum packaging - Continuous hydrolysis of phenolic compounds

Click Here to Buy book on Amazon

134. An FSO reviews a case where pre-cut apple slices marketed as "fresh-cut" turned entirely brown and mushy within 12 hours of refrigeration. The manufacturer claims they dipped the apples in a 0.01% ascorbic acid solution. What technical failure likely caused this spoilage case?
(A) Ascorbic acid actually accelerates the PPO reaction pathways by providing active dissolved oxygen.
(B) Ascorbic acid is a known biochemical activator of endogenous cellulases that cause localized browning.
(C) Low refrigeration temperatures activate heat-shock protein pathways that synthesize dark melanins.
(D) Ascorbic acid acts temporarily by reducing quinones; once depleted, browning proceeds rapidly.

135. A biotechnology engineer is designing a continuous-flow reactor to produce lactose-free milk. To maximize cost-efficiency and ensure no enzyme remains in the final product, which competency-based design must be selected?
(A) Adding active liquid lactase directly into the milk vat and pasteurizing the entire mixture afterwards.
(B) Passing milk through a packed-bed reactor containing covalently immobilised lactase.
(C) Using high-intensity ultrasound waves to spontaneously hydrolyze the disaccharide lactose.
(D) Fermenting the fluid milk with non-pathogenic wild yeast strains that consume lactose.

136. The novel food enzyme transglutaminase is functionally used in the food industry to:
(A) Oxidize unsaturated fatty acids in structured meat products during storage.
(B) Cleave internal peptide bonds in tough muscle tissue cuts to tenderize them.
(C) Catalyze the formation of covalent bonds between glutamine and lysine residues.
(D) Convert simple sucrose molecules into structural isomers like isomaltulose.

137. Match the Regulatory Concepts of Food Enzymes in List I with their Descriptions in List II.
List I: (Regulatory Concepts of Food Enzymes)
P. Processing Aid
Q. Food Additive
R. GRAS (Generally Recognized As Safe)
S. JECFA
List II: (Descriptions)
I. International expert scientific committee that evaluates the safety of food additives and enzymes
II. A substance used during food production that may remain in the final food, fulfilling a technological function in the final product
III. A regulatory designation in the US for substances with a long history of safe use or proven safety
IV. A substance used during processing but not present in the final product in significant amounts, having no technological effect in the final product
(A) P-IV, Q-II, R-III, S-I
(B) P-II, Q-IV, R-III, S-I
(C) P-IV, Q-III, R-II, S-I
(D) P-I, Q-II, R-IV, S-III

NODIA

138. Which of the following statements correctly differentiates competitive from non-competitive enzyme inhibition in the context of food preservation?
(A) Competitive inhibitors compete for the active site, which is overcome by raising substrate levels.
(B) Competitive inhibitors bind to the allosteric site, whereas non-competitive inhibitors bind to the active site.
(C) Non-competitive inhibitors permanently destroy the primary amino acid sequence of the target enzyme.
(D) Competitive inhibitors always lower reaction velocity, while non-competitive inhibitors only affect affinity.

139. Laccase, a novel enzyme increasingly explored in food technology, is best defined biochemically as:
(A) A plant-derived hydrolase enzyme that specifically targets and degrades complex beta-glucans in barley grain.
(B) A multi-copper oxidoreductase that oxidizes phenolic compounds while reducing oxygen to water.
(C) A methyltransferase enzyme that actively transfers functional methyl groups onto pectin polymers.
(D) A highly specific carbohydrate isomerase enzyme that converts galactose molecules into glucose.

140. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R).
Assertion (A): Transglutaminase is heavily utilized in the production of "restructured" meat products, such as formed steaks or surimi.
Reason (R): Transglutaminase acts as a "meat glue" by covalently cross-linking proteins, fundamentally improving the texture, water-holding capacity, and structural integrity of the formed pieces.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

141. Which of the following is NOT a defining characteristic of an enzyme used as a "Processing Aid" under food safety guidelines?
(A) It must perform an active technological function in the finished food product during its shelf life.
(B) It is used in the processing of raw materials to fulfill a technological purpose during treatment.
(C) It may result in the non-intentional but unavoidable presence of residues in the final product.
(D) Residual amounts left in the final packaged product must not pose any human health risks.

142. Consider the effects of processing conditions on enzyme activity:
I. Most food enzymes are completely and irreversibly inactivated by freezing.
II. High Hydrostatic Pressure (HHP) processing can cause protein unfolding and enzyme inactivation without applying high heat.
III. Lowering the water activity (a_w) of a food system generally decreases the rate of enzymatic reactions.
IV. The optimum pH of an enzyme is an absolute value that never shifts, regardless of temperature or ionic strength.
Which of the statements are correct?
(A) I and II only
(B) II and III only
(C) I, III, and IV only
(D) II, III, and IV only

143. Given below are two statements:
Statement I: Laccases are applied in the beverage industry (e.g., wine and beer making) primarily for the stabilization of the product by removing polyphenols that cause haze and oxidative browning.
Statement II: Laccases require hydrogen peroxide as a necessary co-substrate to oxidize polyphenols.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

144. The application of ascorbic acid in guacamole to prevent browning is an example of exploiting a chemical concept where the applied agent:
(A) Covalently cross-links the PPO enzyme proteins, rendering them permanently insoluble.
(B) Competitively blocks atmospheric oxygen molecules from entering the broken plant cells.
(C) Reduces o-quinones back to o-diphenols until the reducing agent is fully oxidized.
(D) Denatures the copper active catalytic site by lowering the temperature of the mixture.

145. Which of the following statements regarding the regulatory status of food enzymes is INCORRECT?
(A) Enzymes used in food processing must be derived from approved microbial, plant, or animal sources.
(B) Recombinant enzymes derived from Genetically Modified Microorganisms (GMMs) are strictly banned from any use in the food industry.
(C) Food enzymes must meet specific purity criteria, including limits on heavy metals and absence of pathogenic microorganisms.
(D) Many enzymes are regulated as processing aids and do not need to be declared in the ingredient list if they are inactivated in the final product.

146. A manufacturer adds an enzyme to a dough formulation. If the FSO needs to ascertain whether the enzyme should be regulated as a Food Additive or a Processing Aid, what is the MOST APPROPRIATE determining factor?
(A) The specific biological source of the enzyme, distinguishing between microbial and plant origins.

Downloaded from www.pdf.tube

(B) The total economic cost of purchasing and preparing the enzyme formulation per industrial batch.
(C) The specific molecular weight and structural amino acid sequence of the active enzyme protein.
(D) Whether the enzyme remains active and exerts a technological effect in the final baked bread.

147. The observed inactivation of polyphenol oxidase in fruit juices treated with High-Pressure Processing (HPP) at 600 MPa is primarily the direct physical effect of:
(A) Disruption of non-covalent interactions leading to the unfolding of the enzyme's tertiary structure.
(B) Sudden and violent boiling of the raw fruit juice caused by exposure to extreme localized pressure.
(C) Covalent cleavage of the enzyme's peptide bonds driven directly by the high-velocity pressure wave.
(D) Rapid and complete physical sublimation of the raw juice's water content under processing conditions.

148. Which of the following pairs of a novel enzyme and its contemporary food industry application is INCORRECTLY matched?
(A) Transglutaminase - Surimi structural network formation
(B) Asparaginase - Mitigation of acrylamide formation in fried potatoes
(C) Glucose oxidase - Reversal of lactose intolerance in milk
(D) Laccase - Cork taint removal in wine

149. An FSO audits a cheese manufacturing plant and discovers the use of an unapproved, highly active microbial protease intended to replace traditional rennet. The resultant cheese has numerous consumer complaints regarding a strong bitter taste. The FSO flags this case because the unapproved enzyme:
(A) Cleaved caseins into hydrophobic bitter peptides due to non-specific proteolytic activity, unlike chymosin.
(B) Failed to coagulate the casein micelles properly, leaving the milk in a completely liquid state during aging.
(C) Acted primarily as a lipase enzyme, causing severe hydrolytic rancidity instead of targeted proteolysis.
(D) Synthesized toxic compounds like cyanogenic glycosides within the curd during the coagulation process.

150. A food technologist needs to validate the safety parameters of an immobilised enzyme reactor used for continuous lactose hydrolysis. Under food safety standards, what specific competency must the technologist demonstrate to ensure the final product is compliant as having used a processing aid?
(A) Demonstrating that the enzyme dramatically alters milk color to visually prove its operational efficacy.
(B) Proving that the enzyme formulation is derived from a mammalian source to meet ancient food purity laws.
(C) Ensuring the enzyme completely sterilizes the milk against bacterial spores, avoiding heat pasteurization.
(D) Verifying the enzyme remains bound to the carrier and does not leak active protein into the product stream.

www.nodia.in

NODIA

ANSWERS

1. (B) They are natural compounds that interfere with the digestion, absorption, or utilization of nutrients.
Anti-nutritional factors are substances generated in natural food substances by the normal metabolism of species. These compounds act to reduce nutrient intake, absorption, digestion, and utilization, occasionally causing adverse physiological effects. Understanding these molecules is essential in food science to implement appropriate processing techniques that effectively mitigate their negative dietary impacts on human health.

2. (A) P-III, Q-II, R-I, S-IV
Phytic acid is predominantly concentrated within wheat bran and legumes, while glucosinolates are characteristic sulfur-containing compounds found in cruciferous vegetables such as cabbage and mustard. Gossypol is a specific polyphenolic pigment located in cottonseed, whereas solanine is a highly toxic glycoalkaloid that naturally accumulates in green potatoes exposed to light during storage.

3. (A) It possesses six phosphate groups on a myo-inositol ring, chelating divalent cations via its strong charge.
Phytic acid consists of a myo-inositol ring fully esterified with six phosphate groups, giving the molecule a high negative charge density over a wide pH range. This structure allows it to act as a powerful chelator of multivalent mineral cations, forming highly insoluble complexes in the intestinal tract that severely limit nutrient absorption.

4. (C) Myo-inositol hexakisphosphate
Phytic acid is chemically designated as myo-inositol hexakisphosphate, representing a saturated cyclic acid with six attached phosphate groups. In plants, this unique organic molecule serves as the principal storage form of phosphorus within seeds and grains. It exhibits strong chelating properties toward key minerals, significantly lowering their overall physiological bioavailability during digestion.

5. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Whole grain cereals serve as rich sources of phytate compounds, which are concentrated in the outer aleurone layer. These compounds exhibit high affinity for multivalent metal ions like iron and zinc, forming highly insoluble phytate-mineral complexes in the gastrointestinal tract. This biochemical interaction directly reduces the systemic bioavailability and absorption of these essential micronutrients.

6. (D) Anthocyanins
Trypsin inhibitors, cyanogenic glycosides, and haemagglutinins are classical plant-derived compounds that negatively affect the nutritional value of foods by interfering with digestion, protein utilization, or metabolic pathways. In contrast, anthocyanins are water-soluble vacuolar pigments that provide red, purple, or blue colors to plants and possess beneficial antioxidant properties, rather than anti-nutritional activities.

7. (B) I, II, and IV only
Germination, lactic acid fermentation, and exogenous enzyme addition all rely on active phytase enzymes to catalyze the sequential hydrolysis of phytic acid into lower inositol phosphates. Germination triggers endogenous plant phytases, fermentation lowers the pH to optimize bacterial and endogenous enzyme activity, and exogenous phytase directly hydrolyzes the phytate. Milling is a mechanical separation process.

8. (C) Statement I is true but Statement II is false.
Phytases are specific esterase enzymes that systematically hydrolyze phytic acid into lower inositol phosphate derivatives and inorganic orthophosphate. However, endogenous cereal phytases do not function optimally in alkaline conditions. Instead, they typically exhibit maximum enzymatic activity in the acidic pH range of approximately five to six, which is characteristic of fermented sourdough matrices.

Click Here to Buy book on Amazon

9. (D) Soaking and malting the pearl millet before formulation
Soaking and malting initiate the natural germination process in pearl millet, activating endogenous phytase enzymes that break down phytic acid. This enzymatic degradation releases bound zinc and iron from insoluble phytate complexes, substantially increasing their physiological bioavailability. This domestic technique effectively enhances mineral nutrition without reducing the overall caloric or macronutrient density of weaning foods.

10. (A) Routine domestic boiling completely eliminates the anti-nutritional effect of phytates.
Phytic acid is a highly heat-stable compound that resists denaturation during standard domestic boiling processes. Although boiling can lead to a slight reduction in phytate levels due to leaching into the cooking water, it is insufficient to eliminate its mineral-chelating effects. Complete removal requires enzymatic hydrolysis via phytases activated during germination or fermentation.

11. (B) II, IV, I, III
Phytase enzymes sequentially catalyze the dephosphorylation of myo-inositol hexakisphosphate. This systematic degradation proceeds from the fully phosphorylated six-phosphate form down to lower inositol phosphate derivatives. The correct sequence of intermediates generated during this continuous hydrolytic pathway starts with hexakisphosphate, followed by pentakisphosphate, then tetrakisphosphate, and finally ends with the bisphosphate form.

12. (B) Decreased biological availability of dietary calcium in the gut
The precipitation of calcium by phytic acid in the intestinal lumen forms highly stable, insoluble calcium-phytate complexes. Because these large chemical complexes cannot be absorbed across the intestinal epithelium, the dietary calcium remains trapped in the digestive tract. This biochemical interaction directly limits the absorption and systemic biological availability of calcium in consumers.

13. (A) Phytic acid - Reduced bioavailability of zinc and iron
Phytic acid is a strong chelator that binds tightly to essential multivalent metal ions in the gastrointestinal tract, directly reducing the bioavailability of zinc and iron. In contrast, glucosinolates are linked to goitrogenic effects, tannins primarily precipitate proteins to reduce digestibility, and protease inhibitors block pancreatic enzymes like trypsin rather than binding or transporting lipids.

14. (C) High levels of phytic acid and tannins chelating the available iron
Unrefined sorghum flour contains high levels of phytic acid and condensed tannins, which act as powerful anti-nutritional factors. These polyphenolic and phosphorylated compounds form highly stable, insoluble complexes with both native and added iron in the digestive tract. This chelating action prevents the absorption of iron, leading to negligible improvements in serum ferritin levels.

15. (D) Soaking, followed by controlled thermal treatment and lactic acid fermentation
Soaking initiates the hydration of ingredients and promotes the leaching of soluble anti-nutrients. Subsequent controlled thermal treatment denatures heat-labile protease inhibitors and lectins. Finally, lactic acid fermentation lowers the pH, optimizing endogenous phytase activity to hydrolyze phytic acid. This integrated sequence maximizes both protein digestibility and mineral bioavailability in the final relief food.

16. (C) Spinach
Spinach is a green leafy vegetable widely recognized for accumulating exceptionally high concentrations of naturally occurring oxalic acid and its salts. These oxalates function as potent anti-nutritional factors by binding to divalent minerals, particularly calcium, in the digestive tract. This biochemical binding severely restricts the absorption and nutritional utilization of these essential dietary minerals.

17. (A) P-IV, Q-II, R-I, S-III
Soluble oxalates exist primarily as potassium and sodium salts, which easily dissolve in aqueous environments, while insoluble oxalates are composed of calcium oxalate crystals. Oxalobacter formigenes is a specialized anaerobic bacterium in the human gut that relies on oxalate degradation for energy. Hyperoxaluria is a medical condition characterized by excessive urinary excretion of oxalate.

NODIA

18. (D) Oxalic acid forms a highly insoluble complex with calcium, severely restricting calcium absorption.
Oxalic acid exhibits a strong chemical affinity for divalent calcium ions, reacting with them to form highly insoluble calcium oxalate complexes. These crystals cannot be digested or absorbed by the intestinal mucosa, preventing calcium utilization. Consequently, consuming high-oxalate foods dramatically reduces the nutritional value and systemic bioavailability of dietary calcium present in the meal.

19. (A) Water-soluble polyphenolic compounds that can precipitate proteins.
Tannins are a complex group of water-soluble polyphenolic compounds widely distributed in the plant kingdom. They are characterized by their ability to form strong hydrophobic interactions and hydrogen bonds with proteins, leading to their precipitation. In food systems, this biochemical action reduces the overall digestibility of dietary proteins and inhibits various digestive enzymes.

20. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Black tea is exceptionally rich in polyphenolic tannins, which actively chelate non-heme iron in the lumen of the small intestine. This biochemical reaction forms highly insoluble, non-absorbable iron-tannin complexes, preventing the uptake of iron by the mucosal cells. Consequently, frequent consumption of tea with meals can significantly deplete iron stores over time.

21. (A) Functioning as competitive inhibitors of the enzyme myrosinase
Dietary tannins are renowned for their ability to bind and precipitate proteins, which imparts a characteristic astringent sensation in the mouth and reduces protein digestibility. They also function as active antioxidants. However, tannins do not act as competitive inhibitors of myrosinase; that specific enzyme is regulated by compartmentalization and glucosinolate substrates in cruciferous plants.

22. (A) I and II only
Excessive dietary oxalate intake negatively impacts health by binding calcium ions in the gastrointestinal tract, severely reducing calcium absorption. Once absorbed, soluble oxalates are excreted via the kidneys, where they can precipitate with calcium to form renal calculi. Oxalates do not cause systemic blood alkalinization or direct depletion of mucosal surface zinc.

23. (C) Statement I is true but Statement II is false.
Hydrolyzable tannins consist of phenolic acids esterified to a carbohydrate core, making them susceptible to chemical or enzymatic cleavage. Conversely, condensed tannins are complex polymers of flavan-3-ols linked by carbon-carbon bonds. These strong interflavan bonds make condensed tannins highly resistant to enzymatic hydrolysis, allowing them to pass largely intact through the human digestive system.

24. (C) Separate the consumption of the beverage from iron-rich meals by at least two hours
Gallotannins present in certain beverages act as potent chelators of non-heme iron within the digestive tract, forming insoluble complexes that block iron absorption. To minimize this negative interaction, individuals with iron-deficiency anemia should avoid consuming these beverages during meals. Separating consumption by at least two hours allows sufficient time for complete iron absorption to occur.

NODIA

25. (D) Oxalates act as primary antioxidants in the bloodstream, preventing lipid peroxidation.
Oxalates do not function as primary antioxidants in the bloodstream. Instead, they are metabolic waste products with no beneficial physiological role in humans. They exhibit high toxicity, with high levels in rhubarb leaves, mechanical irritation from needle-like raphide crystals in taro corms, and a tendency to reduce calcium absorption by forming insoluble complexes in the body.

26. (A) Boiling the leaves in water and discarding the residual liquid
Soluble oxalates, which constitute a significant portion of the total oxalates in green leafy vegetables, are highly water-soluble. Boiling the leaves allows these compounds to readily leach out into the cooking water. Discarding this residual liquid effectively reduces the total oxalate content of the food, thereby enhancing the bioavailability of the remaining dietary calcium.

27. (B) The sensation of astringency in the oral cavity
Tannins possess a uniquely high chemical affinity for proline-rich proteins, which are abundant in human saliva. When tannin-rich foods or beverages are consumed, these polyphenols bind and precipitate salivary proteins in the mouth.

This precipitation deprives the oral cavity of lubricating proteins, resulting in the characteristic dry, puckering sensation known as astringency.

28. (B) Phytic acid - Egg whites
Phytic acid is an organic compound synthesized exclusively by plants as a phosphorus storage molecule, meaning it is entirely absent from animal products like egg whites. Egg whites instead contain different proteins like ovomucoid. Sorghum contains condensed tannins, rhubarb is rich in oxalates, and pomegranates contain hydrolyzable tannins, representing correct botanical sources of these anti-nutrients.

29. (A) Consume calcium-rich foods alongside oxalate-rich foods to bind oxalate in the gut.
Consuming calcium-rich foods alongside high-oxalate items promotes the binding of free oxalic acid to calcium within the digestive tract, forming insoluble calcium oxalate. Because this precipitation occurs in the gut lumen, the oxalate cannot be absorbed into the bloodstream or reach the kidneys. This clinical strategy significantly reduces urinary oxalate levels and prevents stone formation.

30. (C) Treating the grains with alkaline solutions like ammonia or sodium hydroxide
Treating high-tannin sorghum grains with alkaline solutions, such as ammonia or sodium hydroxide, chemically alters the polyphenolic structure of tannins. This alkaline treatment promotes the polymerization or oxidation of tannins, dramatically reducing their solubility and protein-binding capacity. This industrial process effectively neutralizes their anti-nutritional effects, making the sorghum highly suitable for animal feed.

31. (D) Haemagglutinins
Lectins are carbohydrate-binding proteins found in abundance in many legume species. Because they have multiple binding sites, they can bind to sugar residues on the surface of red blood cells, causing them to clump together. This distinctive physiological property of agglutinating erythrocytes is why lectins are widely known by the alternative term haemagglutinins in scientific literature.

32. (A) P-II, Q-I, R-IV, S-III
The Kunitz inhibitor is a heat-labile monomeric protein of twenty-one kilodaltons that primarily targets trypsin. The Bowman-Birk inhibitor is a smaller, highly stable double-headed polypeptide that inhibits both trypsin and chymotrypsin. Cystatins are specialized inhibitors that target cysteine proteases, whereas ovomucoid is the predominant, highly glycosylated trypsin inhibitor found in avian egg whites.

33. (B) They bind to specific carbohydrate residues on the surface of intestinal epithelial cells, disrupting the brush border.
Dietary lectins are highly resistant to gastric acidity and digestive proteases. Upon entering the small intestine, they bind specifically and reversibly to carbohydrate moieties on the surface of epithelial cells lining the mucosa. This binding disrupts the brush border membrane, impairing nutrient absorption, increasing permeability, and triggering acute gastrointestinal symptoms in affected consumers.

34. (D) Proteins that form stable complexes with digestive enzymes like trypsin, reducing their activity.
Protease inhibitors are naturally occurring proteins found in many plant foods, particularly legumes. They function by physically binding to the active sites of digestive enzymes, such as trypsin and chymotrypsin, in the intestinal lumen. This binding forms stable, inactive complexes that prevent the enzymes from hydrolyzing dietary proteins, thereby significantly reducing protein digestibility.

35. (C) (A) is true but (R) is false.
Raw red kidney beans contain high concentrations of Phytohaemagglutinin, which causes severe acute gastroenteritis. However, this lectin is not a heat-stable toxin; it is highly sensitive to wet heat and is completely denatured by proper boiling. In contrast, slow cooking at low temperatures is insufficient to destroy it, sometimes even increasing its toxicity.

36. (C) It is highly thermostable and can survive prolonged boiling at 100°C.
The Kunitz trypsin inhibitor is a single polypeptide chain of approximately twenty-one kilodaltons with a specific affinity for trypsin. Unlike the smaller Bowman-Birk inhibitor, Kunitz inhibitors are relatively heat-sensitive and are easily denatured by standard commercial wet thermal processing. Inactivating this protein is

Downloaded from www.pdf.tube

critical to improving the overall protein efficiency ratio of soy products.

37. (A) I, II, and IV only
Lectins are characterized by their specific, reversible carbohydrate-binding activity and their high resistance to proteolytic enzymes in the gut. They are, however, heat-labile and can be effectively inactivated through proper wet thermal processing. Pancreatic hypertrophy and cholecystokinin release are physiological effects classically associated with active trypsin inhibitors rather than dietary lectins.

38. (C) Statement I is true but Statement II is false.
The Bowman-Birk inhibitor possesses seven disulfide bonds within its compact structure, imparting exceptional stability against thermal denaturation and acid digestion. However, it is a double-headed inhibitor, meaning it contains two distinct, independent active sites. One site specifically binds and inhibits trypsin, while the other site is dedicated to inhibiting chymotrypsin, showing broad inhibitory activity.

39. (B) Incomplete denaturation of Phytohaemagglutinin (PHA) due to insufficient cooking temperature.
Phytohaemagglutinin is a highly toxic lectin concentrated in red kidney beans. Although sensitive to boiling at one hundred degrees, it remains stable and active at lower temperatures like seventy-five degrees. Cooking these beans in a slow cooker without reaching a boil fails to denature the lectin, leading to acute gastroenteritis among consumers due to active toxin ingestion.

40. (C) Trypsin inhibitors function by permanently modifying the primary amino acid sequence of trypsinogen.
Trypsin inhibitors do not alter the primary amino acid sequence of trypsinogen or trypsin. Instead, they act as competitive inhibitors that physically bind to the active site of mature trypsin, forming stable, inactive complexes. This binding prevents substrate access, triggering a feedback mechanism that stimulates cholecystokinin release and leads to pancreatic hypertrophy in monogastric animals.

41. (A) II, IV, I, III
Ingesting active trypsin inhibitors initiates a sequence of physiological events starting with the formation of stable trypsin-inhibitor complexes in the duodenum. This binding causes a sharp decrease in free active trypsin in the gut. In response, the intestinal mucosa secretes cholecystokinin, which chronically stimulates the pancreas, eventually leading to pancreatic hypertrophy and hyperplasia.

42. (A) Lectins binding to specific carbohydrate moieties on adjacent red blood cells, causing cross-linking.
Haemagglutination occurs because lectin molecules possess multiple, highly specific carbohydrate-binding sites. When mixed with blood, these proteins bind to specific glycan residues present on the surface membranes of neighboring erythrocytes. This multivalent binding allows the lectins to act as physical bridges, cross-linking the cells together into a visible, clumped network of red blood cells.

NODIA

43. (B) Castor bean - Ricin
Ricin is an extremely potent, highly toxic ribosome-inactivating protein naturally found in the seeds of the castor oil plant, making this pair correctly matched. In contrast, solanine is a glycoalkaloid found in potatoes, Bowman-Birk inhibitors are proteins characteristic of soybeans, and Phytohaemagglutinin is the specific toxic lectin concentrated within red kidney beans.

44. (B) Lectins
The clinical presentation points to lectin toxicity. Lectins are specialized plant proteins abundant in raw legumes and sprouts that resist digestion by pepsin and other proteases. They bind with high affinity to carbohydrate receptors on the intestinal epithelial cells, disrupting mucosal integrity and causing acute gastrointestinal symptoms. This pathogenesis distinguishes them from tannins, oxalates, or glucosinolates.

45. (A) Residual trypsin inhibitor activity
Soybean meal must undergo sufficient thermal treatment to denature trypsin inhibitors, which are the primary heat-labile anti-nutritional factors in soy. Assaying residual trypsin inhibitor activity serves as the standard industrial performance indicator for the desolventizer-toaster process. This monitoring ensures that the soy protein is safe, digestible, and free from active enzymes that cause pancreatic hypertrophy.

46. (C) Myrosinase
Myrosinase, chemically classified as a beta-thioglucosidase, is the specific endogenous plant

enzyme responsible for hydrolyzing glucosinolates. Under normal conditions, the enzyme and its substrates are physically separated within different cellular compartments. When tissue damage occurs, they come into contact, initiating the rapid hydrolysis of glucosinolates into various active, toxic, and pungent compounds.

47. (A) P-II, Q-III, R-IV, S-I
Thiocyanates act as competitive inhibitors that block iodine uptake by the thyroid gland. Oxazolidine-2-thiones, such as goitrin, irreversibly interfere with thyroid hormone synthesis by blocking iodine organification. Isothiocyanates are highly volatile, pungent compounds found in mustard, while glucosinolates are the intact hydrophilic parent glycosides stored safely inside plant cell vacuoles.

48. (C) They inhibit the enzyme thyroid peroxidase, blocking the incorporation of iodine into thyroglobulin.
Oxazolidine-2-thiones, such as goitrin, are potent goitrogenic compounds that exert their effects directly within the thyroid gland. They inhibit thyroid peroxidase, the key enzyme responsible for oxidizing iodide and attaching it to tyrosine residues. This inhibition prevents the organification of iodine and stops thyroglobulin synthesis, leading to decreased thyroid hormone levels and subsequent goiter.

49. (B) Amphiphilic glycosides composed of a lipid-soluble aglycone and water-soluble sugar chains.
Saponins are a diverse group of naturally occurring plant glycosides characterized by their amphiphilic structure. This structure consists of a hydrophobic, lipophilic steroid or triterpenoid core, known as the aglycone or sapogenin, linked to one or more hydrophilic sugar chains. This dual nature gives them surfactant properties, allowing them to form stable foams in water.

50. (C) (A) is true but (R) is false.
Saponins exhibit potent hemolytic activity when introduced directly into the bloodstream because they interact with membrane cholesterol, disrupting erythrocyte structure. However, they are generally non-toxic when ingested orally because they are poorly absorbed by the intestinal tract, passing through intact. They are not degraded by salivary amylase, as amylase targets alpha-1,4-glycosidic bonds in starch, not saponins.

51. (A) Fabaceae (e.g., Soybeans, Lentils)
The families Brassicaceae, Cruciferae, and Cleomaceae are characteristically rich in glucosinolates, which hydrolyze to produce goitrogenic compounds like thiocyanates and isothiocyanates. In contrast, the Fabaceae family, which contains soybeans and lentils, is not a major source of glucosinolates. Instead, legumes typically contain different anti-nutritional factors such as protease inhibitors, lectins, and phytic acid.

52. (A) I, II, and IV only
Saponins are amphiphilic compounds that reduce surface tension, forming stable foams, and impart a characteristic bitter taste to foods like quinoa. They also bind to cholesterol in the gut, forming insoluble complexes. However, saponins are highly heat-stable molecules that are not easily destroyed or inactivated by standard domestic boiling processes.

53. (D) Statement I is false but Statement II is true.
The hydrolysis of glucosinolates by myrosinase does not always produce thiocyanates; pH, temperature, and specific protein factors dictate whether isothiocyanates, nitriles, or epithionitriles form. However, this reaction strictly requires tissue damage, such as chewing or crushing, to break down cellular compartments and allow the physically separated enzyme and substrate to interact.

54. (D) Thiocyanates derived from cyanogens and glucosinolates competitively block thyroid iodine uptake.
Cassava contains cyanogenic glycosides, while cabbage is rich in glucosinolates. When ingested, these compounds release thiocyanates during metabolism. Thiocyanate ions possess a similar ionic charge and size to iodide ions, allowing them to competitively inhibit the sodium-iodide symporter in the thyroid. This blocks iodine uptake, severely compromising hormone synthesis in iodine-deficient populations.

55. (B) Saponins act as powerful protease inhibitors in the duodenum.
Saponins are glycosides consisting of a sapogenin aglycone bound to sugar chains. They can increase the permeability of intestinal cells and are easily removed from quinoa by washing. However, they do not function as protease inhibitors in the duodenum; that role is performed by specialized

Click Here to Buy book on Amazon

proteins like Kunitz and Bowman-Birk inhibitors that bind digestive enzymes.

56. (C) Subjecting the intact seeds to rapid thermal inactivation to destroy myrosinase before crushing.
Glucosinolates in rapeseed are harmless until they undergo hydrolysis catalyzed by the endogenous enzyme myrosinase. By subjecting the intact seeds to rapid thermal treatment before crushing, the myrosinase enzyme is completely denatured and inactivated. This prevents any subsequent enzymatic hydrolysis during processing, ensuring that no toxic goitrogenic compounds are generated in the edible meal.

57. (D) Saponins binding with cholesterol and bile acids in the gut, forming mixed micelles that are excreted.
The cholesterol-lowering effect of dietary saponins is driven by their physical interactions within the gastrointestinal tract. Saponins bind directly to dietary cholesterol and bile acids, forming large, insoluble mixed micelles that cannot be absorbed across the intestinal wall. These complexes are subsequently excreted in the feces, forcing the liver to deplete systemic cholesterol to synthesize new bile acids.

58. (A) Taste profile - Sweet and umami
Saponins possess a steroid or triterpenoid aglycone structure and act as active natural surfactants that trigger erythrocyte lysis in vitro. However, they do not possess a sweet or umami taste profile. Instead, saponins are renowned for imparting a strong, highly objectionable bitter taste and an astringent, throat-irritating sensation to foods such as raw quinoa.

59. (B) Incorporating an abrasive polishing or aqueous washing step to remove the outer seed coat pericarp.
Saponins in quinoa are highly concentrated within the outer pericarp layer of the seed coat. Dry-milling raw quinoa without dehulling retains these bitter compounds in the flour, causing foaming and sensory issues. Incorporating abrasive polishing or thorough washing with water physically removes the saponin-rich outer layer, successfully eliminating bitterness and foaming from the product.

NODIA

60. (B) The pungency of mustard is derived from allyl isothiocyanate, which is inherently a product of glucosinolate hydrolysis.
The characteristic sharp, pungent flavor of mustard is caused by allyl isothiocyanate. This volatile compound is generated only when glucosinolates are hydrolyzed by the enzyme myrosinase. Because this hydrolysis reaction simultaneously produces goitrogenic products, it is biochemically impossible to retain the authentic pungency of mustard while making the product completely free of goitrogenic activity.

61. (A) Linamarin
Linamarin is the predominant cyanogenic glycoside synthesized by cassava plants, accounting for over ninety percent of the total cyanogenic content in the roots and leaves. Upon cellular disruption, this glycoside is hydrolyzed by endogenous enzymes to release toxic hydrogen cyanide. Proper processing of cassava is therefore crucial to reduce linamarin levels and prevent chronic cyanide exposure.

62. (A) P-II, Q-I, R-III, S-IV
Amygdalin is the characteristic cyanogenic glycoside found in bitter almonds and apricot kernels, while dhurrin is concentrated in sorghum plants. Linamarin is the major cyanogenic compound located in cassava and lima beans. Prunasin is a related monoglycoside that naturally occurs in wild cherry bark, representing the specific distribution of these secondary metabolites in plants.

63. (D) Cyanogenic glycosides are hydrolyzed by endogenous beta-glucosidases when cellular compartmentalization is disrupted.
In cyanogenic plants, glycosides and their hydrolytic enzymes are stored in separate cellular compartments. When tissue damage occurs due to chewing, crushing, or processing, this physical barrier is broken down, bringing the components together. Endogenous beta-glucosidases then hydrolyze the glycosides, releasing an intermediate cyanohydrin that dissociates to yield highly toxic, volatile hydrogen cyanide gas.

64. (C) Nitrogen-containing, naturally occurring organic compounds that often have significant pharmacological or toxic effects.
Alkaloids constitute a broad class of naturally occurring organic compounds that contain at least one nitrogen atom, typically in a heterocyclic ring. Synthesized primarily by plants

capric and caproic acids point directly to extensive lipid hydrolysis. This hydrolytic rancidity is caused by the uncontrolled activity of active lipases. These enzymes can originate natively from raw milk or be secreted by psychrotrophic contaminant bacteria during cold storage before cheese making.

120. (C) Pretreating the olive paste with pectinases and cellulases to break down the malaxation emulsion.
Olive oil is trapped within the cell vacuoles of the fruit mesocarp, surrounded by polysaccharide walls. Pretreating olive paste with pectinases and cellulases enzymatically degrades these structural cell walls. This breakdown destabilizes the oil-water emulsion during malaxation, allowing oil droplets to coalesce and separate easily. This process increases extraction yields without requiring heat or chemical solvents.

121. (D) Quinones
Polyphenol oxidase is a copper-containing enzyme that catalyzes the oxidation of phenolic compounds in the presence of molecular oxygen. It hydroxylates monophenols to o-diphenols and subsequently oxidizes these diphenols into highly reactive o-quinones. These quinones undergo rapid, non-enzymatic polymerization and react with amino acids, ultimately forming the dark-colored pigments known as melanins.

122. (A) P-III, Q-II, R-I, S-IV
Adsorption binds enzymes to support surfaces via weak physical forces, while covalent binding attaches them through strong chemical bonds. Entrapment physically confines enzymes inside porous gel structures like calcium alginate without chemical modification. Cross-linking uses bifunctional reagents, such as glutaraldehyde, to chemically link enzyme molecules to each other, creating large, insoluble, and stable aggregates.

123. (B) It co-oxidizes carotenoid pigments, resulting in the desirable bleaching of the bread crumb.
Lipoxygenase in wheat flour catalyzes the oxidation of polyunsaturated fatty acids to produce hydroperoxides. During this active reaction, intermediate free radicals are generated that co-oxidize and destroy yellow carotenoid pigments naturally present in the flour. This biochemical co-oxidation results in a desirable bleaching effect, producing a bright, white bread crumb preferred by many consumers.

124. (B) Confining an enzyme to a solid support for continuous use and easy recovery from the product.
Enzyme immobilisation is a key technique in food biotechnology where active enzymes are physically or chemically restricted to a defined region or solid support. This confinement allows the enzymes to be easily separated from the reaction mixture after processing. Consequently, the enzyme can be reused continuously in bioreactors, preventing any protein contamination in the final food product.

125. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Blanching is a critical thermal pretreatment step in vegetable processing. It involves exposing vegetables to hot water or steam for a short duration prior to freezing. This heat treatment denatures and inactivates highly active endogenous enzymes, particularly lipoxygenase and peroxidase. Inactivating these enzymes prevents lipid oxidation, off-flavor development, and undesirable color loss during subsequent frozen storage.

126. (C) Homogenization in an aqueous buffer
Industrial enzyme immobilisation techniques focus on confining enzymes to solid supports, utilizing methods such as gel entrapment, covalent attachment to inert carriers, or cross-linking with bifunctional reagents. Homogenization in an aqueous buffer is a physical extraction and solubilization process that disperses enzymes freely in solution. It does not immobilize the enzyme, making recovery from the product impossible.

127. (D) I, II, III, and IV
Polyphenol oxidase is a copper-dependent enzyme that catalyzes both the monophenolase activity of hydroxylating monophenols to diphenols and the diphenolase activity of oxidizing diphenols to quinones. The generated o-quinones are highly reactive electrophiles that spontaneously polymerize to produce brown or black melanin pigments, representing the complete biochemically driven process of enzymatic browning in damaged plant tissues.

128. (C) Statement I is true but Statement II is false.
Lipoxygenase oxidizes polyunsaturated fatty acids to generate hydroperoxides, which decompose into volatile aldehydes and ketones that cause objectionable "beany" off-flavors in soy products.

Downloaded from www.pdf.tube

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

than mitochondrial respiration, amygdalin releases cyanide to block cytochrome c oxidase, and gossypol is a male antifertility agent and cytotoxin, rather than a primary thyroid-disrupting goitrogen like glucosinolates.

74. (A) Bitter almonds (Benzaldehyde)
During the enzymatic hydrolysis of amygdalin in bitter almonds, the glycoside is cleaved to release hydrogen cyanide and benzaldehyde. Benzaldehyde is the specific volatile compound responsible for the characteristic, sweet-bitter aroma of almonds. Recognizing this distinct scent on the breath of victims or in the food helps confirm acute cyanide poisoning from cyanogenic plants.

75. (B) Grating/rasping the roots followed by extensive water washing and pressing.
Grating or rasping cassava roots physically disrupts the plant cells, bringing the cyanogenic glycosides into direct contact with endogenous beta-glucosidases. This initiates rapid hydrolysis, converting glycosides into volatile hydrogen cyanide. Subsequent extensive washing with water dissolves and removes the soluble toxins, while mechanical pressing expels the cyanide-laden liquid, successfully detoxifying the starch.

76. (B) Leaching water-soluble ANFs like tannins, phytates, and soluble oxalates into the discardable soak water.
Soaking legumes in water for extended periods exploits the physical solubility of various anti-nutritional factors. Compounds such as phytic acid, soluble oxalates, tannins, and low-molecular-weight carbohydrates slowly migrate out of the seed tissues and into the surrounding water. Discarding this soak water prior to cooking effectively removes these dissolved anti-nutrients from the final food product.

77. (A) P-II, Q-I, R-III, S-IV
Oxidoreductases catalyze biological oxidation-reduction reactions involving electron transfer. Hydrolases cleave chemical bonds through the addition of water, while lyases catalyze the non-hydrolytic and non-oxidative elimination of groups to form double bonds. Isomerases catalyze structural rearrangements within a single molecule, facilitating conversion between different geometric or optical isomers.

78. (C) Lactic acid bakeries lower the dough pH, optimizing the activity of endogenous flour phytases which degrade phytic acid.
Sourdough fermentation by lactic acid bacteria produces organic acids that lower the pH of the dough matrix to approximately 4.5 to 5.5. This acidic environment matches the optimal pH range for endogenous wheat flour phytase enzymes. Consequently, these activated enzymes rapidly hydrolyze phytic acid, significantly improving the bioavailability of essential minerals in the bread.

79. (D) Catalyze the direct transfer of electrons from one molecule (the reductant) to another (the oxidant).
According to the International Union of Biochemistry classification, oxidoreductases comprise the first class of enzymes. They specifically catalyze chemical reactions where electrons, hydrogen atoms, or oxygen atoms are transferred between molecules. This group includes crucial food enzymes such as polyphenol oxidase, lipoxygenase, and peroxidase, which play major roles in color and flavor development.

NODIA

80. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Germination triggers a cascade of biochemical changes in seeds, activating and synthesizing endogenous enzymes such as phytases, amylases, and proteases de novo. These enzymes break down complex storage molecules, hydrolyzing phytic acid, starches, and proteins into simpler, highly digestible components. This metabolic process directly improves the overall nutritional value and mineral bioavailability of grains.

81. (B) Accumulation of high molecular weight starch polymers
Sprouting legumes activates endogenous hydrolytic enzymes, which reduce phytic acid and flatulence-causing oligosaccharides like stachyose and raffinose, while synthesizing ascorbic acid. During this process, active amylases break down complex starches into simpler sugars. Therefore, germination leads to the degradation of starch rather than the accumulation of high-molecular-weight starch polymers in the seed.

82. (A) I and III only
Bowman-Birk protease inhibitors possess a highly disulfide-bonded structure, making them more heat-stable than Kunitz inhibitors. Similarly, toxic phytohaemagglutinins are heat-labile and

as defense mechanisms, these basic compounds exert potent pharmacological or toxicological effects on humans and animals. Common dietary examples include caffeine, solanine, and various pyrrolizidine derivatives found in crops.

65. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Consuming poorly processed bitter cassava leads to high dietary intake of linamarin, which releases cyanide in the body. Human detoxification systems convert this cyanide into thiocyanate using sulfur-containing amino acids like methionine and cysteine. This process depletes essential sulfur amino acids, causing a nutritional and metabolic imbalance that leads to the paralytic disease konzo.

66. (D) Spinach
Lima beans, bamboo shoots, and apple seeds are well-documented botanical sources that contain varying levels of cyanogenic glycosides like linamarin or amygdalin. In contrast, spinach does not synthesize cyanogenic compounds. The primary anti-nutritional factors concentrated in spinach are instead soluble and insoluble oxalates, which affect calcium bioavailability rather than releasing toxic hydrogen cyanide.

67. (B) I, II, and IV only
Solanine is a toxic glycoalkaloid that concentrates in the green parts and skin of potato tubers, with synthesis stimulated directly by light exposure. It acts as a potent inhibitor of acetylcholinesterase, disrupting nervous transmission. Crucially, solanine is highly heat-stable, meaning standard domestic boiling or baking processes are entirely insufficient to destroy or inactivate it.

68. (A) Both Statement I and Statement II are true.
The enzymatic degradation of the cyanogenic glycoside amygdalin proceeds sequentially, releasing two glucose molecules and a cyanohydrin intermediate. This intermediate is further hydrolyzed by hydroxynitrile lyase, which catalyzes the final cleavage of the cyanohydrin into benzaldehyde and toxic hydrogen cyanide gas. Both statements accurately describe the biochemical pathway of cyanogenesis in Prunus species.

69. (A) Gastrointestinal distress and neurological symptoms due to heat-stable glycoalkaloids.
Exposing potatoes to light triggers the synthesis of chlorophyll, causing a green color, and stimulates the co-synthesis of toxic glycoalkaloids like solanine. Because glycoalkaloids are highly heat-stable compounds, standard domestic boiling does not destroy them. Consuming these green potatoes results in acute toxicity, characterized by severe gastrointestinal irritation and neurological disturbances in consumers.

70. (D) Glycoalkaloids in tomatoes (tomatine) are most concentrated in the fully ripe, red fruit.
Pyrrolizidine alkaloids cause veno-occlusive liver damage, tropane alkaloids act as anticholinergic agents, and solanine is the major glycoalkaloid of potatoes. However, the glycoalkaloid tomatine is not highly concentrated in ripe red tomatoes. Instead, tomatine levels are exceptionally high in green, unripe tomatoes and decrease dramatically to negligible trace amounts as the fruit ripens and turns red.

71. (A) II, III, IV, I
Cyanogenesis begins when plant tissue damage breaks down cellular compartmentalization. This disruption allows the cyanogenic glycoside substrate to come into contact with endogenous beta-glucosidases, which hydrolyze the sugar molecules. This cleavage generates a cyanohydrin intermediate, which subsequently undergoes spontaneous or enzyme-catalyzed dissociation to release volatile, toxic hydrogen cyanide gas into the environment.

72. (C) Its binding to the ferric iron in cytochrome c oxidase, abruptly halting the mitochondrial electron transport chain.
The acute, lethal toxicity of hydrogen cyanide occurs because it acts as a powerful mitochondrial poison. Cyanide ions bind with exceptionally high affinity to the ferric iron within the heme group of cytochrome c oxidase in the electron transport chain. This binding completely blocks cellular respiration, halting ATP production and causing rapid, fatal tissue hypoxia.

73. (D) Pyrrolizidine alkaloids - Veno-occlusive liver disease
Pyrrolizidine alkaloids, found in weeds contaminating grain crops, are highly hepatotoxic and cause veno-occlusive liver disease. Conversely, solanine inhibits acetylcholinesterase rather

Click Here to Buy book on Amazon

reducing viscosity. In contrast, beta-amylase and glucoamylase are exo-acting enzymes that trim successive maltose or glucose units from starch ends.

92. (A) P-IV, Q-III, R-II, S-I
Papain is a cysteine protease sourced from the latex of papaya fruit, while bromelain is extracted from the stem or fruit of pineapple. Ficin is a related protease isolated from fig latex. Chymosin, the primary enzyme in animal rennet, is historically sourced from the abomasum, which is the fourth stomach of young calves.

93. (A) It is an exo-enzyme that cleaves successive maltose units from the non-reducing end of the starch chain.
Beta-amylase is a highly specific exo-enzyme that acts on starch polymers by cleaving successive maltose units from the non-reducing ends of glucose chains. It hydrolyzes only alpha-one-four-glycosidic linkages and cannot bypass alpha-one-six branch points in amylopectin, leaving behind large limit dextrins. This activity contrasts with randomly acting endo-amylases that liquefy starch pastes.

94. (C) An aspartic acid protease that specifically cleaves the Phe105-Met106 bond in kappa-casein.
Chymosin is a highly specific aspartic acid protease that serves as the primary active enzyme in traditional rennet. During cheese making, it targets and cleaves the unique phenylalanine-one-hundred-and-five to methionine-one-hundred-and-six peptide bond in kappa-casein. This cleavage destabilizes the hydrophilic protective layer of casein micelles, initiating rapid milk coagulation and curd formation.

95. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Supplementing bread dough with alpha-amylase significantly delays staling and crumb firming during storage. The enzyme hydrolyzes gelatinized starch during the initial baking phase, producing smaller dextrin chains. These short-chain dextrins physically interfere with the retrogradation and recrystallization of amylopectin polymers as the bread cools, maintaining a soft and flexible crumb structure over time.

96. (C) Pectin methylesterase
Papain, bromelain, and ficin are active plant-derived proteases widely utilized to tenderize tough cuts of meat by hydrolyzing myofibrillar and connective tissue proteins. Conversely, pectin methylesterase is a highly specific carbohydrate-modifying enzyme that de-esterifies pectin in plant cell walls. It exhibits no proteolytic activity and cannot be used for the tenderisation of meat.

97. (A) I and II only
Proteases play a vital role in cheese ripening by hydrolyzing caseins into short peptides and free amino acids, which are crucial for flavor development. However, excessive or non-specific proteolytic activity can produce hydrophobic peptides, causing a bitter defect. These enzymes are not entirely inactivated by pasteurization, nor do they ferment lactose into lactic acid.

98. (C) Statement I is true but Statement II is false.
Amyloglucosidase is an exo-acting enzyme that hydrolyzes both terminal alpha-one-four and alpha-one-six glycosidic linkages, converting starch polymers into monomeric glucose. However, it is not sourced from animal pancreas for high-fructose corn syrup production. Instead, industrial amyloglucosidase is produced through the fermentation of fungal strains, particularly Aspergillus niger, ensuring cost-effective and highly active enzymes.

99. (A) The meat texture will become excessively mushy and pasty due to profound proteolysis.
Bromelain is a highly active protease that hydrolyzes both muscle fibers and connective collagen. Leaving meat in contact with a high concentration of this enzyme for twenty-four hours at room temperature leads to over-tenderization. This uncontrolled proteolysis breaks down the structural proteins completely, turning the meat texture unappealingly mushy, soft, and pasty.

100. (C) Fungal amylases survive the entire baking process and continue to break down starch during bread storage.
Fungal alpha-amylases from Aspergillus oryzae possess lower thermal stability compared to bacterial amylases. They are denatured early during the baking process when temperatures reach approximately seventy to seventy-five degrees. This early inactivation prevents them from surviving the entire baking process, thereby avoiding the excessive starch breakdown that leads to a sticky, gummy crumb.

Downloaded from www.pdf.tube

easily inactivated by wet thermal treatments like pressure cooking. However, phytic acid is highly heat-stable and resists brief boiling, while condensed tannins are also highly resistant to standard pasteurization processes.

83. (C) Statement I is true but Statement II is false.
Enzymes possess high specificity, allowing them to catalyze precise chemical reactions without generating unwanted side products. However, the lock-and-key model does not suggest that active sites undergo significant conformational changes to bind any substrate. That description refers to the induced-fit model; the lock-and-key model assumes a rigid, pre-formed complementary structure.

84. (C) Secreting extracellular proteases and phytases to degrade anti-nutritional factors and improve bioavailability.
During tempeh fermentation, the filamentous fungus Rhizopus oligosporus grows throughout the soybeans. The mold secretes highly active extracellular enzymes, including proteases and phytases, into the substrate. These enzymes systematically hydrolyze complex soy proteins into digestible peptides and break down phytic acid. This biological process significantly reduces anti-nutritional factors, improving the food's overall digestibility.

85. (A) Enzymes alter the equilibrium constant of a chemical reaction, forcing incomplete reactions to completion.
Enzymes function strictly as biological catalysts that accelerate the rate of chemical reactions by lowering the activation energy barrier. They do not alter the thermodynamic equilibrium constant of a reaction, nor can they force thermodynamically unfavorable or incomplete reactions to completion. They only speed up the rate at which equilibrium is reached in food systems.

86. (D) Extrusion cooking
Extrusion cooking is a highly efficient high-temperature, short-time industrial process. It subjects legume flours to intense heat, mechanical shear, and high pressure, which rapidly denature and inactivate multiple heat-labile anti-nutritional factors such as protease inhibitors and lectins. This thermal and mechanical processing significantly enhances protein digestibility and nutritional quality in bulk ingredients.

87. (B) Organic acid production lowering the pH to the optimal range for endogenous cereal phytase activity.
Lactic acid fermentation of cereal gruels produces organic acids, primarily lactic acid, which accumulate and lower the pH of the system. This acidification shifts the pH into the optimal range of 4.5 to 5.5, which is required for the activation of endogenous cereal phytase enzymes. These active enzymes then rapidly hydrolyze phytic acid.

88. (C) Soaking - Volatilization of complex carbohydrates into gases
Roasting thermally denatures heat-labile proteins, fermentation utilizes microbial enzymes to degrade anti-nutrients, and milling physically removes outer layers where these compounds concentrate. However, soaking does not volatilize complex carbohydrates into gases. Instead, soaking reduces anti-nutritional factors primarily through physical leaching of water-soluble compounds like phytates and tannins into the discardable water.

89. (D) Rasping and wet-pressing cassava → Roasting/Extruding soybeans → Debranning sorghum → Final blending.
Rasping and wet-pressing cassava effectively eliminates cyanogenic glycosides through enzymatic breakdown and water leaching. Roasting or extruding soybeans thermally destroys heat-labile trypsin inhibitors. Debranning sorghum mechanically removes the outer testa layer where condensed tannins are highly concentrated. Blending these processed fractions produces a composite flour with minimized levels of all three anti-nutritive factors.

90. (C) 12 minutes
The D-value represents the time required at a specific temperature to reduce the concentration of a target substance by ninety percent, or one log cycle. To achieve a ninety-nine point nine percent reduction, the process must run for three decimal reduction cycles. Multiplying three D-values by four minutes per cycle yields a minimum holding time of twelve minutes.

91. (B) Alpha-amylase
Alpha-amylase is a classic endo-enzyme that randomly cleaves internal alpha-one-four-glycosidic bonds within amylose and amylopectin molecules. This non-specific cleavage avoids branch points and rapidly breaks down large starch molecules into smaller dextrin chains,

NODIA

110. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Citrus juices rely on pectin to maintain the suspension of insoluble cloud particles. Raw juice contains endogenous pectin methylesterase, which hydrolyzes methyl esters to produce de-esterified pectic acid. This acid binds to calcium ions, forming insoluble calcium pectate that precipitates, causing clarification. Pasteurization heat denatures this enzyme, effectively protecting the desirable cloudy appearance of the juice.

111. (D) Catalyze the Maillard browning reaction in baked goods
Lipases catalyze the hydrolysis of fats, cause rancidity, and are used in interesterification for structured lipids. However, they do not catalyze the Maillard reaction, which is a non-enzymatic chemical reaction between reducing sugars and amino acids triggered by heat. This browning process does not require any lipid substrates or lipolytic enzyme activity to proceed.

112. (B) I, II, and IV only
Pectinases are extensively applied in fruit juice manufacturing to increase extraction yields and fully clarify juices like apple juice by breaking down structural pectin. They are also paired with cellulases for complete pulp maceration. However, pectinases are not used to increase ketchup viscosity; instead, they degrade pectin, which would dramatically reduce the thickness of tomato paste.

113. (C) Statement I is true but Statement II is false.
Hydrolytic rancidity occurs when lipases hydrolyze milk lipids, releasing short-chain free fatty acids like butyric acid, which impart strong, unpleasant soapy odors. While this rancidity significantly degrades the sensory quality and consumer acceptability of dairy products, it does not pose a lethal toxicological threat or cause acute hepatotoxicity. It is primarily a quality defect, not a safety hazard.

114. (D) Cellulases and pectinases
Plant cell walls are composed of a rigid network of cellulose fibers embedded in a pectin matrix. Utilizing a combination of cellulases and pectinases during grape processing digests these structural polysaccharides, breaking down the cell walls. This enzymatic maceration facilitates the rapid release of trapped juices and natural anthocyanin pigments, significantly increasing overall extraction yields.

115. (A) It requires pectin to be completely de-esterified into pectic acid before it can act.
Pectin lyase is unique because it specifically targets highly esterified pectins directly. Unlike polygalacturonase, it does not require prior de-esterification by pectin methylesterase. It cleaves the alpha-one-four-glycosidic bonds via beta-elimination, rapidly reducing viscosity and generating an unsaturated product without adding water, making it a highly valuable enzyme in the fruit juice industry.

116. (C) Ensuring rigorous pasteurization of the cream to completely inactivate endogenous milk lipases.
Soapy and rancid off-flavors in butter are caused by hydrolytic rancidity, which results from the enzymatic cleavage of milk fat by active lipases. Ensuring rigorous pasteurization of the raw cream before churning effectively denatures and inactivates these endogenous milk lipases and any bacterial enzymes. This heat treatment prevents subsequent lipid hydrolysis, preserving butter quality during storage.

117. (A) A sharp decrease in juice viscosity by hydrolyzing the pectin backbone.
Polygalacturonase is a hydrolytic pectinase that targets the polygalacturonic acid backbone of pectin. Adding this enzyme to raw apple juice breaks down the high-molecular-weight pectin polymers that hold water and suspended solids. This hydrolysis rapidly lowers the viscosity of the juice and destabilizes the colloidal suspension, allowing suspended particles to settle out easily for complete clarification.

118. (D) Cellulase - Enzymatic browning in cut apples
Lipoxygenase bleaches flour, pectin methylesterase causes orange juice clarification, and lipase triggers milk rancidity. However, cellulase is not the enzyme responsible for browning in cut apples. Enzymatic browning is catalyzed by polyphenol oxidase, which oxidizes phenolic compounds into highly reactive quinones. Cellulases instead digest structural cellulose and do not participate in pigment-forming browning pathways.

119. (B) Uncontrolled action of native milk lipases or psychrotrophic bacterial lipases.
The development of soapy flavors and the accumulation of short-chain free fatty acids like

Click Here to Buy book on Amazon

technological role. GRAS is a safety designation based on history of safe use, and JECFA is the international expert committee that evaluates the safety of food additives.

138. (A) Competitive inhibitors compete for the active site, which is overcome by raising substrate levels.
Competitive inhibitors possess structural similarity to the substrate, allowing them to bind directly to the enzyme's active site and block substrate access. This inhibition is reversible and can be completely overcome by increasing the substrate concentration. Non-competitive inhibitors instead bind to an allosteric site, reducing the maximum reaction velocity regardless of how much substrate is added.

139. (B) A multi-copper oxidoreductase that oxidizes phenolic compounds while reducing oxygen to water.
Laccase is a multi-copper oxidoreductase enzyme that catalyzes the monoelectronic oxidation of a broad range of phenolic and non-phenolic substrates. During this enzymatic reaction, laccase utilizes molecular oxygen as the terminal electron acceptor, directly reducing it to harmless water molecules. In food processing, it is used for beer stabilization, fruit juice clarification, and baking applications.

140. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Transglutaminase is highly valued in meat restructuring because it acts as an effective biological glue. The enzyme catalyzes the formation of covalent isopeptide bonds between glutamine and lysine amino acid residues in proteins. This cross-linking binds distinct meat pieces together, significantly improving the overall texture, water binding, and structural integrity of reformed steaks or surimi.

141. (A) It must perform an active technological function in the finished food product during its shelf life.
Under international food safety guidelines, an enzyme classified as a processing aid is used during raw material treatment to fulfill a technological purpose. Unlike food additives, processing aids must be inactivated or removed from the final product, meaning they cannot perform any active technological function in the finished food during its subsequent packaging and shelf life.

142. (B) II and III only
High Hydrostatic Pressure can denature enzymes without heat by disrupting non-covalent bonds, and reducing water activity significantly slows enzymatic reaction rates by restricting substrate diffusion. However, freezing does not completely or irreversibly inactivate most food enzymes, as they can reactivate upon thawing. Additionally, an enzyme's optimum pH can shift depending on temperature and ionic strength.

143. (C) Statement I is true but Statement II is false.
Laccases are applied in the beverage industry to oxidize polyphenols that cause haze, oxidative browning, and quality defects during storage. However, they do not require hydrogen peroxide as a co-substrate. Unlike peroxidases, laccases use molecular oxygen as the electron acceptor, reducing it to water, which makes them highly convenient and safe for liquid food systems.

NODIA

144. (C) Reduces o-quinones back to o-diphenols until the reducing agent is fully oxidized.
Citric and ascorbic acids are commonly added to guacamole to prevent browning. While citric acid lowers the pH, ascorbic acid functions specifically as a reducing agent. It chemically reduces the highly reactive o-quinones produced by polyphenol oxidase back to colorless o-diphenols. This action prevents pigment polymerization until the pool of ascorbic acid is completely oxidized and depleted.

145. (B) Recombinant enzymes derived from Genetically Modified Microorganisms (GMMs) are strictly banned from any use in the food industry.
Recombinant enzymes derived from genetically modified microorganisms are not banned from the food industry. In fact, many commercial food-grade enzymes, such as recombinant chymosin used in cheese making, are produced using genetically modified yeast or bacterial hosts. These enzymes must meet strict safety, purity, and allergenicity standards before being approved for commercial food processing.

146. (D) Whether the enzyme remains active and exerts a technological effect in the final baked bread.
Under regulatory standards, the distinction between a food additive and a processing aid depends on the presence of active technological function in the final food. If the added enzyme is completely inactivated during baking and

However, lipoxygenase activity is not inhibited by oxygen. On the contrary, molecular oxygen is an essential co-substrate required for the enzyme to catalyze the oxidation of fatty acids in food systems.

129. (B) Converts quinones back to diphenols and directly inhibits polyphenol oxidase.
Sulfur dioxide acts as a powerful anti-browning agent in dried fruits through multiple mechanisms. It functions as a reducing agent, chemically converting reactive o-quinones back into colorless o-diphenols before they can polymerize into melanins. Additionally, sulfur dioxide interacts directly with the active site of polyphenol oxidase, inhibiting the enzyme to prevent further oxidative browning.

130. (D) Immobilisation renders the enzyme heat-labile, meaning it can only operate at refrigeration temperatures.
Immobilised glucose isomerase is widely used in high-fructose corn syrup production to continuously convert glucose to fructose. Crucially, immobilisation does not make the enzyme heat-labile. Instead, it significantly enhances the enzyme's thermal and operational stability, allowing the continuous reactors to operate efficiently at high temperatures, typically between fifty-five and sixty-five degrees, to prevent microbial contamination.

131. (A) III, II, IV, I
Enzymatic browning begins when polyphenol oxidase hydroxylates monophenols into o-diphenols. Next, the enzyme oxidizes these diphenols into highly reactive o-quinones. These quinones then undergo rapid, spontaneous non-enzymatic reactions, binding with amino acids or other quinone molecules to form complex intermediates. Finally, these intermediates polymerize to generate the dark, insoluble pigments known as melanins.

132. (C) Enhancing thermal and operational stability, allowing continuous processing at higher temperatures.
Covalently binding an industrial enzyme to an inorganic silica support restricts its conformational flexibility, shielding the protein from unfolding. This physical stabilization significantly enhances the enzyme's resistance to thermal denaturation and operational shear forces. Consequently, the immobilised enzyme can operate continuously in bioreactors at higher temperatures and for extended periods without losing catalytic activity.

133. (A) Citric acid addition - Lowering pH below the optimum for PPO activity
Citric acid acts as an effective anti-browning agent primarily by lowering the pH of the food matrix below three. This high acidity is far below the optimal pH range for polyphenol oxidase activity, which is typically between five and seven, thereby inactivating the enzyme. It also exhibits weak chelating properties toward the copper cofactor.

134. (D) Ascorbic acid acts temporarily by reducing quinones; once depleted, browning proceeds rapidly.
Ascorbic acid prevents browning by chemically reducing reactive o-quinones back to colorless o-diphenols. However, this reaction is stoichiometric, meaning the ascorbic acid is consumed and oxidized to dehydroascorbic acid. Once the low concentration of applied ascorbic acid is fully depleted, the active polyphenol oxidase resume oxidizing diphenols, allowing rapid and unchecked melanin formation to proceed.

135. (B) Passing milk through a packed-bed reactor containing covalently immobilised lactase.
Utilizing a packed-bed reactor containing covalently immobilised lactase represents the optimal design for continuous lactose hydrolysis. This setup allows fluid milk to pass through while the enzymes remain firmly attached to the solid support, ensuring no active protein leaks into the final product. It also permits continuous operation and reuse of the enzyme, maximizing cost-efficiency.

136. (C) Catalyze the formation of covalent bonds between glutamine and lysine residues.
Transglutaminase is an acyltransferase enzyme that catalyzes the formation of strong isopeptide bonds between the gamma-carboxamide group of glutamine residues and the epsilon-amino group of lysine residues. This covalent cross-linking modifies protein structures in food systems, allowing processors to restructure meats, improve water-holding capacity, and enhance the overall texture of various dairy and bakery products.

137. (A) P-IV, Q-II, R-III, S-I
A processing aid is used during production but is absent or inactive in the final food, whereas a food additive remains in the product to fulfill a

Downloaded from www.pdf.tube

101. (A) II, I, III
Producing high-fructose corn syrup from corn starch involves three distinct enzymatic steps. First, liquefied starch is produced through liquefaction using thermostable alpha-amylase to break down gelatinized starch. Next, glucoamylase is added for saccharification to yield monomeric glucose. Finally, the glucose solution undergoes isomerization by glucose isomerase to convert glucose into sweet fructose.

102. (D) Proteolytic action of Aspergillus oryzae proteases releasing abundant free glutamic acid.
During the long-term fermentation of soy sauce, Aspergillus oryzae molds synthesize and secrete highly active proteases. These enzymes slowly digest soy proteins, breaking them down into small peptides and free amino acids. The liberation of abundant free glutamic acid, which interacts with sodium ions, is directly responsible for developing the rich, savory umami flavor profile.

103. (B) Papain - Chill-proofing of beer to prevent protein-polyphenol haze.
Papain is widely used in the beverage industry for the chill-proofing of beer. When beer is cooled, soluble proteins and polyphenols can associate to form an unsightly colloidal haze. Adding papain hydrolyzes these complex proteins into smaller, highly soluble peptides, preventing haze formation and ensuring the beer remains clear and bright even at cold temperatures.

104. (C) Bacterial alpha-amylase is highly thermostable, surviving the baking process and over-hydrolyzing the starch backbone during cooling.
Bacterial alpha-amylase exhibits exceptional thermal stability, withstanding temperatures up to ninety degrees. During baking, it survives the oven heat and continues to actively hydrolyze starch polymers into dextrins even as the bread cools. This unchecked, prolonged enzymatic activity over-liquefies the starch backbone, resulting in a highly objectionable gummy crumb texture and structural collapse.

105. (D) Maltogenic amylase, which trims maltose from starch and is moderately heat-labile
Maltogenic amylase is highly effective for anti-firming applications in cakes and breads. It acts as an exo-amylase, trimming short maltose units from amylopectin outer chains, which prevents starch retrogradation during storage. Because it is moderately heat-labile, it is completely inactivated during baking, avoiding the excessive internal starch breakdown that causes gummy textures or structural collapse.

106. (A) Hydrolyze ester bonds in triglycerides to release fatty acids, diacylglycerols, and monoacylglycerols.
Food-grade lipases are specialized hydrolase enzymes that target lipid molecules. They act at the lipid-water interface, specifically catalyzing the cleavage of ester bonds within triglyceride molecules. This hydrolysis releases free fatty acids along with diacylglycerols, monoacylglycerols, and glycerol, which are crucial for flavor development in cheese or modifying fats for structured lipids.

107. (A) P-II, Q-III, R-I
Pectin methylesterase removes methyl ester groups from pectin, producing pectic acid and methanol. Polygalacturonase acts on the main polymer chain, hydrolyzing alpha-one-four-glycosidic bonds in polygalacturonic acid. Pectin lyase cleaves these glycosidic bonds in highly esterified pectins via a non-hydrolytic beta-elimination reaction, generating an unsaturated double bond at the non-reducing end of the product.

108. (B) Exogenous lipases, such as those from calf prestomach or microbial sources, are essential for developing the characteristic piquant flavor of Romano, Provolone, and Blue cheeses.
Exogenous lipases play a vital role in cheese manufacturing, particularly for traditional Italian varieties. These enzymes hydrolyze milk fats to release short and medium-chain free fatty acids, such as butyric, caproic, and caprylic acids. This controlled lipolysis is directly responsible for developing the sharp, pungent, and highly desirable piquant flavors characteristic of Provolone and Romano cheeses.

109. (A) Enzymes (endoglucanases, exoglucanases, cellobiases) that synergistically hydrolyze beta-1,4-bonds in cellulose.
Cellulases are a multi-enzyme system comprising endoglucanases, exoglucanases, and cellobiases that act synergistically to degrade plant cell walls. Endoglucanases randomly cleave internal amorphous regions, exoglucanases trim cellobiose from chain ends, and cellobiases hydrolyze cellobiose into glucose. In food processing, they are widely used to liquefy fruit pulp, clarify juices, and extract bioactive ingredients.

NODIA

performs no further function in the bread, it is classified as a processing aid. If it remains active and functional, it is regulated as an additive.

147. (A) Disruption of non-covalent interactions leading to the unfolding of the enzyme's tertiary structure.
High-Pressure Processing at six hundred megapascals inactivates enzymes like polyphenol oxidase by disrupting weak, non-covalent bonds such as hydrogen bonds and hydrophobic interactions. This disruption leads to the unfolding and denaturation of the enzyme's complex tertiary structure, rendering it catalytically inactive. Crucially, HPP achieves this without cleaving covalent peptide bonds, preserving the juice's sensory and nutritional quality.

148. (C) Glucose oxidase - Reversal of lactose intolerance in milk
Transglutaminase restructures meat, asparaginase mitigates acrylamide in fried foods, and laccase removes cork taint in wine. However, glucose oxidase does not reverse lactose intolerance in milk. That therapeutic function is performed exclusively by lactase (beta-galactosidase), which hydrolyzes lactose into glucose and galactose. Glucose oxidase instead catalyzes the oxidation of glucose, producing gluconic acid and hydrogen peroxide.

149. (A) Cleaved caseins into hydrophobic bitter peptides due to non-specific proteolytic activity, unlike chymosin.
Unlike highly specific chymosin, many unapproved microbial proteases exhibit broad, non-specific proteolytic activity. During cheese ripening, these aggressive enzymes hydrolyze milk caseins past the initial coagulation stage, continuously cleaving peptide bonds. This excessive, non-specific breakdown releases high levels of low-molecular-weight hydrophobic peptides, which accumulate in the cheese curd and impart a highly objectionable, strong bitter taste.

150. (D) Verifying the enzyme remains bound to the carrier and does not leak active protein into the product stream.
To comply with food safety standards regulating processing aids, the technologist must demonstrate that the enzyme does not remain as an active residue in the final food. In an immobilised system, this requires verifying that the lactase enzyme remains covalently bound to the support matrix and does not leak active protein into the milk stream during continuous operations.

www.nodia.in

Click Here to Buy book on Amazon

29. A manufacturer wishes to create an omega-3 enriched clear fruit water. What is the most critical concept application required to achieve this?
(A) Utilizing solid phytosterol fractions as primary surfactants to thoroughly emulsify hydrophobic omega-3 oil droplets.
(B) Adding highly concentrated active myrosinase enzymes to rapidly hydrolyze and dissolve the omega-3 triglycerides.
(C) Heating the beverage to extreme pasteurization temperatures to thermally force the omega-3 molecules into a clear solution.
(D) Utilizing advanced nanoemulsion technology to disperse lipophilic omega-3 fatty acids in an aqueous system without cloudiness.

30. Identify the incorrect pair of a functional ingredient and its target health condition.
(A) Probiotics - Irritable Bowel Syndrome (IBS)
(B) Omega-3 fatty acids - Hypertriglyceridemia
(C) Plant stanols - Osteoporosis
(D) Prebiotics - Constipation

31. Which of the following defines a "Functional Food"?
(A) Foods that are processed using advanced physical technologies solely to possess highly extended shelf stability without synthetic preservatives.
(B) Foods that inherently contain, or are enriched with, bioactive compounds providing demonstrated physiological benefits beyond basic nutrition.
(C) Foods formulated for therapeutic administration exclusively via medical enteral feeding tubes in specialized clinical healthcare settings.
(D) Foods that are manufactured from chemical raw materials synthesized completely from inorganic laboratory precursors and industrial elements.

32. Which of the following statements correctly identifies the active functional component in oats responsible for cardiovascular health benefits?
(A) High concentration of naturally occurring statins
(B) High concentration of plant-derived isoflavones
(C) High concentration of the carotenoid lycopene
(D) Soluble dietary fiber known as oat beta-glucan

NODIA

33. Match the functional food in List I with its major bioactive component in List II.
List I: (Functional Food)
P. Soy
Q. Tomatoes
R. Green Tea
S. Oats
List II: (Bioactive Component)
I. Epigallocatechin gallate (EGCG)
II. Beta-glucan
III. Isoflavones (Genistein, Daidzein)
IV. Lycopene
Which of the following is the correct matching?
(A) P-III, Q-IV, R-I, S-II
(B) P-IV, Q-III, R-II, S-I
(C) P-III, Q-I, R-IV, S-II
(D) P-II, Q-IV, R-I, S-III

34. Which functional food is recognized for containing phytoestrogens that may help mitigate menopausal symptoms?
(A) Green tea
(B) Oats
(C) Soy
(D) Tomatoes

35. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): Regular consumption of processed tomato products is associated with a reduced risk of prostate cancer.
Reason (R): Tomatoes contain lycopene, a potent antioxidant carotenoid that exhibits higher bioavailability when thermally processed.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

36. Green tea is considered a functional food primarily due to its high content of all the following, EXCEPT:
(A) Catechins
(B) Flavonols
(C) Epicatechin
(D) Anthocyanins

7. Consider the following statements regarding nutraceutical classification:
I. Nutraceuticals can be classified based on their food source.
II. Nutraceuticals can be classified based on their mechanism of action.
III. Nutraceuticals can be classified based on their chemical nature.
IV. Nutraceuticals are legally classified as Schedule H drugs under FSSAI.
Which of the above statements are correct?
(A) I, II, and IV
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and III

8. Read the given statements and select the correct option.
Statement I: Flavonoids are water-soluble plant pigments that contribute to the color of many fruits and flowers.
Statement II: All flavonoids exhibit strong provitamin A activity in the human digestive system.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

9. Identify the incorrect statement regarding the bioavailability of phytochemicals.
(A) The complex physical and chemical matrix of food significantly restricts or enhances the systemic absorption of active phytochemicals.
(B) Mechanical processing techniques like milling universally increase the bioaccessibility and bioavailability of all phytochemical classes.
(C) Co-ingestion of healthy lipid sources substantially improves the intestinal uptake of lipophilic phytochemical compounds.
(D) Endogenous gut microbiota plays an indispensable physiological role in metabolizing complex dietary polyphenols into bioactive forms.

10. What is the primary cause-and-effect relationship between mild thermal processing of tomatoes and lycopene bioavailability?
(A) Thermal processing causes extensive chemical oxidation of lycopene, resulting in a dramatic loss of its overall biological activity.
(B) Thermal processing disrupts rigid plant cell walls and converts trans-isomers of lycopene to highly bioavailable cis-isomers.
(C) Thermal processing forms strong covalent bonds between lycopene and dietary fiber, rendering the compound completely unabsorbable.
(D) Thermal processing inactivates the crucial endogenous myrosinase enzyme, thereby completely preventing downstream lycopene absorption.

11. Identify the correct pair of phytochemicals and their specific subclass.
(A) Epigallocatechin gallate (EGCG) – Polyphenolic compound
(B) Quercetin – Lipophilic carotenoid compound
(C) Zeaxanthin – Sulfur-containing glucosinolate
(D) Sulforaphane – Polymeric flavonoid compound

12. A Food Safety Officer inspects a dietary supplement marketed as a powerful antioxidant containing high levels of extracted anthocyanins. The product claims to cure visual impairment overnight. Based on nutraceutical principles, what is the most appropriate regulatory assessment?
(A) The claim is scientifically valid because anthocyanins directly regenerate optic nerve tissues.
(B) The product is compliant as long as the anthocyanins are extracted from organic berries.
(C) The product is misbranded because nutraceuticals cannot legally claim to cure diseases overnight.
(D) The claim is valid if the manufacturer provides a single internal lab report proving high concentration.

13. Arrange the following steps in the general sequence for commercial extraction and purification of phytochemicals:
I. Solvent extraction
II. Harvesting and drying of plant material
III. Chromatographic purification
IV. Concentration and solvent removal
Which of the following represents the correct sequence?

NODIA

44. When formulating a tomato-based functional soup intended to deliver maximum lycopene benefits, which processing step is conceptually most critical?
(A) Ensuring the soup is served ice-cold at all times to prevent thermal molecular degradation.
(B) Thoroughly clarifying the soup matrix during processing to completely remove insoluble fibers.
(C) Incorporating a lipid source like olive oil and applying thermal processing to release lycopene.
(D) Removing all naturally occurring organic acids to neutralize the final pH of the soup mixture.

45. Identify the incorrect pair of a bioactive compound and its primary food source.
(A) Avenanthramides - Cultivated oats
(B) Genistein - Whole soybeans
(C) Rutin - Common buckwheat seeds
(D) Epigallocatechin gallate - Fresh tomatoes

46. How does a "Health Claim" fundamentally differ from a "Nutrient Content Claim" on a food label?
(A) Nutrient content claims describe the biological relationship between a food component and clinical disease, whereas health claims strictly define the standard serving level.
(B) Health claims represent unregulated promotional marketing tools lacking scientific basis, whereas nutrient content claims are subject to rigorous national standardization.
(C) Health claims describe a relationship between a food component and a health condition, whereas nutrient content claims describe the specific concentration level of a nutrient.
(D) Nutrient content claims are legally mandatory on all packaged retail food products, whereas health claims of any biological nature are completely illegal in India.

47. According to FSSAI regulations, which of the following falls under the category of Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food?
(A) Processed foods containing exclusively standard culinary spices and botanical ingredients like ground turmeric.
(B) Special foods formulated with specific bioactive ingredients intended to supplement nutritional intake in a normal diet.
(C) Standard processed infant milk substitutes and infant formulas designed for pediatric nutritional support.
(D) Raw unprocessed agricultural commodities sold loose in bulk quantities within domestic wholesale markets.

48. Match the type of claim in List I with its appropriate example in List II.
List I: (Type of Claim)
P. Nutrient Content Claim
Q. Disease Risk Reduction Claim
R. Health Claim (Physiological function)
S. Non-Addition Claim
List II: (Example)
I. "Calcium builds strong bones."
II. "A diet low in sodium may reduce the risk of high blood pressure."
III. "Good source of dietary fiber."
IV. "No added sugar."
Which of the following is the correct matching?
(A) P-I, Q-II, R-III, S-IV
(B) P-III, Q-I, R-II, S-IV
(C) P-II, Q-III, R-IV, S-I
(D) P-III, Q-II, R-I, S-IV

49. Under the FSSAI (Health Supplements, Nutraceuticals, etc.) Regulations, 2016, what is required for a manufacturer to make a "disease risk reduction claim"?
(A) Obtaining formal pre-market approval from the Food Authority supported by rigorous and robust scientific clinical data.
(B) Receiving official prior written approval and international clearance directly from the World Health Organization.
(C) Filing a simplified voluntary self-declaration document with the administrative staff at the local municipal office.
(D) Adding a minimum of three distinct therapeutic pharmaceutical drugs into the final formulation of the food product.

50. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): A food package bearing the claim "High in Vitamin C" is making a nutrient content claim.
Reason (R): Nutrient content claims indicate the specific therapeutic effect a nutrient will have on

Downloaded from www.pdf.tube

(D) Galactooligosaccharides (GOS)

22. Consider the following statements about Omega-3 fatty acids:
I. They are polyunsaturated fatty acids characterized by a double bond at the third carbon atom from the methyl end.
II. They promote the synthesis of highly pro-inflammatory eicosanoids.
III. EPA and DHA are predominantly found in marine sources like oily fish and microalgae.
IV. They are highly resistant to lipid oxidation during high-temperature processing.
Which of the above statements are correct?
(A) II and IV
(B) I, II, and III
(C) I and III
(D) I, III, and IV

23. Read the given statements and select the correct option.
Statement I: Synbiotics refer to products that contain both probiotics and prebiotics acting synergistically.
Statement II: The prebiotic component in a synbiotic product serves to selectively inhibit the growth of the probiotic strain during gastric transit.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

24. Identify the incorrect statement regarding the formulation of probiotic foods.
(A) High water activity and ambient storage uniformly enhance probiotic viability over time.
(B) Probiotic strains must be able to survive the acidic environment of the stomach.
(C) Probiotics must remain viable throughout the shelf life of the food product.
(D) Encapsulation techniques can protect probiotics against harsh gastrointestinal conditions.

25. What is the technological effect of esterifying plant sterols to fatty acids before incorporating them into functional foods like margarine?
(A) It reduces their cholesterol-lowering efficacy in the gut.
(B) It significantly increases their solubility in lipid matrices.
(C) It transforms them into potent antioxidants for preserving the food.
(D) It prevents them from surviving the pasteurization process.

NODIA

26. Identify the correct pair regarding dietary fibers and their primary function.
(A) Cellulose – Highly fermentable prebiotic compound in the human distal colon
(B) Inulin – Enhances calcium absorption and selectively modulates gut microflora
(C) Lignin – Rapidly digested and metabolized to provide immediate cellular energy
(D) Pectin – Actively reduces probiotic colonization and intestinal cell adhesion

27. A functional beverage label states: "Contains one billion live cultures." During shelf-life testing at the end of 6 months, a Food Safety Officer (FSO) finds only one thousand live cultures per serving. Which principle applies here?
(A) The product is non-compliant as it fails to deliver the claimed count of viable cells at the end of its shelf life.
(B) The product is compliant because probiotic strains will rapidly replicate and multiply inside the host's gut after consumption.
(C) The product is compliant provided that the inactive or dead bacterial cells still provide documented postbiotic health benefits.
(D) The product is non-compliant because liquid-based food matrices are legally prohibited from containing any live bacterial cultures.

28. Arrange the following events in the sequence of successful probiotic colonization and action in the human host:
I. Adhesion to intestinal mucosa
II. Survival through gastric acid and bile salts
III. Ingestion of a viable probiotic strain
IV. Competitive exclusion of pathogenic bacteria
Which of the following represents the correct sequence?
(A) III, I, II, IV
(B) II, III, I, IV
(C) III, II, I, IV
(D) I, III, IV, II

58. Arrange the sequence of steps for obtaining approval for a health claim not currently specified under FSSAI regulations:
I. Review by the FSSAI Scientific Panel
II. Submission of dossier with clinical and scientific data
III. Issuance of approval or rejection by the Food Authority
IV. Formulation of the proposed claim by the FBO
Which of the following represents the correct sequence?
(A) II, IV, I, III
(B) IV, II, I, III
(C) IV, I, II, III
(D) I, II, IV, III

59. A manufacturer wants to label a calcium-enriched biscuit with a health claim. To comply with FSSAI regulations, which condition must strictly be met regarding the calcium?
(A) It must be present at a level to justify the claim, without exceeding the established tolerable upper intake limit or RDA.
(B) It must be extracted and derived entirely from natural marine coral formations to ensure complete biological activity.
(C) It must significantly exceed the standard RDA levels in each serving to guarantee immediate therapeutic bone healing.
(D) It must be paired with pharmaceutical-grade chemical painkillers to assist with absorption in joint-related conditions.

60. Identify the incorrect pair regarding regulatory classifications.
(A) RDA - Recommended Dietary Allowance
(B) FSMP - Food for Special Medical Purpose
(C) FBO - Functional Botanical Organism
(D) FSDU - Food for Special Dietary Use

61. What is the fundamental principle of organic farming?
(A) Maximizing total crop yield per acre using the maximum legally permissible application rates of synthetic fertilizers and chemical pesticides.
(B) Growing agricultural crops inside controlled environments utilizing soil-less hydroponic systems and synthetic liquid nutrient solutions.
(C) Modifying the underlying genetic structure of commercial crops to withstand the aggressive application of harsh organic chemical herbicides.
(D) Developing an ecological production management system that systematically promotes and enhances biodiversity, biological cycles, and soil health.

62. Which of the following is an accurate statement regarding organic food production?
(A) High-dose food irradiation is a standard and legally permitted method used for preserving certified organic products.
(B) Untreated municipal sewage sludge represents the preferred organic nitrogen fertilizer in certified production systems.
(C) The deliberate use of genetically modified organisms (GMOs) or transgenic crops is strictly prohibited in organic farming.
(D) Highly toxic synthetic chemical fungicides are permitted if they are applied at exactly half of the standard label dose.

63. Match the organic certification/regulatory term in List I with its description in List II.
List I: (Certification/Regulatory Term)
P. NPOP
Q. PGS-India
R. Jaivik Bharat
S. APEDA
List II: (Description)
I. Participatory Guarantee System for localized organic certification
II. The unified logo for certified organic food in India
III. National Programme for Organic Production
IV. Agency implementing NPOP
Which of the following is the correct matching?
(A) P-I, Q-II, R-III, S-IV
(B) P-III, Q-I, R-II, S-IV
(C) P-III, Q-II, R-I, S-IV
(D) P-IV, Q-I, R-II, S-III

64. Under the Participatory Guarantee System (PGS-India), who primarily conducts the inspection and certification of the organic farms?
(A) Independent and accredited international third-party certification auditors.
(B) Staff from the Food Safety and Standards Authority of India (FSSAI) exclusively.
(C) Executive representatives of the corporate sponsors purchasing the farm produce.
(D) Organized peer groups of local farmers who ensure mutual regulatory compliance.

Click Here to Buy book on Amazon

37. Consider the following statements about functional foods:
I. They must be consumed as part of a normal diet, not as pills or capsules.
II. They provide demonstrated physiological benefits.
III. They are regulated identically to pharmaceutical drugs in India.
IV. They can occur naturally or be created through technological intervention.
Which of the above statements are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

38. Read the given statements and select the correct option.
Statement I: The beta-glucan present in oats forms a viscous gel in the digestive tract, which traps bile acids and reduces cholesterol absorption.
Statement II: Functional foods like oats must be genetically modified to produce beta-glucan.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

39. Identify the incorrect statement distinguishing a functional food from a nutraceutical.
(A) Functional foods are formulated and typically consumed in the form of conventional food matrices like bread and juices.
(B) Nutraceuticals are purified compounds routinely manufactured and sold in medicinal dosage forms like capsules and tablets.
(C) Both product categories are designed to provide targeted physiological health benefits beyond basic nutritional roles.
(D) Functional foods are manufactured and marketed exclusively for treating severe acute clinical diseases in hospitalized patients.

40. What is the physiological effect of consuming soy protein in replacement of animal protein in a typical diet?
(A) It contributes to the lowering of total and LDL cholesterol.
(B) It drastically increases low-density lipoprotein (LDL) cholesterol levels.
(C) It impairs the absorption of essential fatty acids.
(D) It depletes the body's natural reserves of vitamin B12.

41. Identify the correct pair representing a functional food and its primary purported health benefit.
(A) Green tea - Enhances deep sleep due to high physiological melatonin content
(B) Soy - Supports cardiovascular health and maintains optimal bone density
(C) Oats - Prevents acute clinical scurvy due to high organic Vitamin C content
(D) Tomatoes - Directly cures type 1 diabetes through insulin-like compounds

42. A functional food manufacturer claims their new green tea beverage "reduces the risk of cardiovascular disease." As a Food Safety Officer (FSO), evaluating this claim under Indian regulations involves verifying which of the following?
(A) Whether the formulated beverage tastes completely authentic and contains legally permitted artificial food colors.
(B) Whether the scientific evidence substantiating the specific health claim is formally evaluated and approved by the Food Authority.
(C) Whether the liquid beverage product contains at least fifty percent pure caffeine molecules by overall fluid volume.
(D) Whether the raw green tea leaves used in manufacturing were imported exclusively from certified farms in northern Japan.

NODIA

43. Arrange the following steps in the enzymatic oxidation of tea leaves (which reduces catechin content, turning green tea into black tea):
I. Cell wall disruption via rolling
II. Plucking of fresh tea leaves
III. Exposure to oxygen causing polyphenol oxidase activity
IV. Firing/Drying to halt enzyme activity
Which of the following represents the correct sequence?
(A) II, I, III, IV
(B) I, II, IV, III
(C) II, III, I, IV
(D) III, II, I, IV

(A) I, II, III, IV
(B) II, IV, I, III
(C) I, III, IV, II
(D) II, I, IV, III

14. A food technologist wants to increase the oxidative stability of a lipid-based food product using natural phytochemicals. Which of the following compounds would be most effective for this specific application?
(A) Glucosinolate compounds containing aliphatic side chains
(B) Phytosterols such as sitosterol and campesterol
(C) Phenolic compounds including tocopherols and flavonoids
(D) Insoluble dietary fibers such as cellulose and lignins

15. Identify the incorrect pair regarding nutraceuticals and their functional properties.
(A) Resveratrol - Promotes cardiovascular health
(B) Phytic acid - Enhances dietary iron absorption
(C) Lutein - Protects macular and visual health
(D) Allicin - Exhibits broad antimicrobial action

16. Which of the following definitions best describes prebiotics?
(A) Viable and active microflora strains which, when administered orally in standardized amounts, systematically confer a physiological health benefit.
(B) Artificial biocatalytic enzymes added to high-moisture functional beverages to actively support the metabolic digestion of dairy lactose.
(C) Key dietary essential amino acids required to stimulate the biological synthesis and cellular activity of gut-associated lymphoid tissues.
(D) Non-digestible carbohydrates that selectively stimulate the growth, activity, and colonization of beneficial microbial species in the human colon.

17. Which of the following is a widely recognized and utilized probiotic bacterial genus in functional foods?
(A) Lactobacillus
(B) Salmonella
(C) Clostridium
(D) Pseudomonas

18. Match the lipid component in List I with its characteristic feature in List II.
List I: (Lipid Component)
P. Alpha-linolenic acid (ALA)
Q. Eicosapentaenoic acid (EPA)
R. Plant sterols
S. Trans-fatty acids
List II: (Characteristic Feature)
I. Competes with dietary cholesterol for micellar incorporation
II. Plant-derived omega-3 precursor
III. Strictly regulated due to negative cardiovascular impact
IV. Marine-derived omega-3 with strong anti-inflammatory properties
Which of the following is the correct matching?
(A) P-IV, Q-II, R-III, S-I
(B) P-II, Q-I, R-IV, S-III
(C) P-II, Q-IV, R-I, S-III
(D) P-I, Q-IV, R-II, S-III

19. By what primary mechanism do dietary plant sterols (phytosterols) lower blood cholesterol levels?
(A) By competing with cholesterol for absorption in the small intestine.
(B) By inhibiting the HMG-CoA reductase enzyme in the liver.
(C) By increasing the degradation of low-density lipoproteins in the bloodstream.
(D) By converting systemic cholesterol into harmless bile acids directly in the stomach.

20. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): The human body can efficiently convert large amounts of plant-derived Alpha-linolenic acid (ALA) into Docosahexaenoic acid (DHA).
Reason (R): DHA is an essential structural component of the brain and cerebral cortex.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

21. All of the following are examples of established prebiotic compounds, EXCEPT:
(A) Inulin
(B) Steviol glycosides
(C) Fructooligosaccharides (FOS)

Downloaded from www.pdf.tube

the consumer's body.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

51. Which of the following statements is strictly prohibited on a nutraceutical product label under FSSAI regulations?
(A) "Cures severe clinical depression within one week of use."
(B) "Supports and maintains a healthy human immune system."
(C) "Serves as a rich dietary source of essential amino acids."
(D) "Helps support and promote healthy structural joint function."

52. Consider the following statements regarding FSSAI regulations on Nutraceuticals:
I. They must not claim to cure or mitigate any specific disease.
II. The quantity of nutrients added shall not exceed the Recommended Dietary Allowance (RDA).
III. They can be administered intravenously if recommended by a physician.
IV. The label must bear a prominent statement "NOT FOR MEDICINAL USE".
Which of the above statements are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

53. Read the given statements and select the correct option.
Statement I: Nutrient function claims describe the physiological role of the nutrient in growth, development, and normal functions of the body.
Statement II: Functional foods in India are allowed to make therapeutic claims if they contain imported herbs.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

54. Identify the incorrect statement regarding the regulatory framework for nutraceuticals in India.
(A) Ingredients used must be listed in the permitted schedules of the FSSAI regulations.
(B) The product label must clearly indicate the recommended daily usage.
(C) The addition of synthetic hormones is permitted if justified by an Ayurvedic practitioner.
(D) The product label must warn that it should not be used as a substitute for a varied diet.

NODIA

55. What is the regulatory effect if a manufacturer uses an unapproved novel ingredient in a nutraceutical product without FSSAI clearance?
(A) The unapproved product is automatically reclassified and regulated under standard rules for traditional Indian foods.
(B) The manufacturing company is immediately awarded a provisional commercial patent by the intellectual property office.
(C) The formulated product is permitted to remain in retail distribution but is strictly restricted to adult consumers.
(D) The product is deemed non-compliant, legally unsafe, and is subjected to mandatory market recall or heavy penalties.

56. Identify the correct pair of FSSAI regulatory term and its definition.
(A) Food for Special Medical Purpose (FSMP) – Specially processed food intended for dietary management of a specific disease.
(B) Health Supplement – Food formulated and marketed specifically to diagnose, treat, or cure a clinical medical condition.
(C) Novel Food – Food or ingredient that has a documented, continuous history of safe human consumption in domestic markets.
(D) Recommended Dietary Allowance – The absolute maximum safe limit of a nutrient above which physiological toxicity is observed.

57. A food label states "Contains 5g of oat beta-glucan. Oat beta-glucan reduces blood cholesterol." During label evaluation, a Food Safety Officer (FSO) should classify this as a:
(A) Nutrient comparative claim
(B) Disease risk reduction claim
(C) Nutrient content claim
(D) Misbranded pharmaceutical claim

CHAPTER 05

Nutraceuticals, Functional Foods, Organic Foods and Genetically Modified Foods

1. Which of the following best defines a nutraceutical according to modern food science paradigms?
(A) A food or food component providing health and medical benefits, including disease prevention or treatment.
(B) Any synthetic chemical additive used to extend shelf life and enhance the aesthetic appeal of food.
(C) A genetically engineered crop developed primarily to tolerate the application of broad-spectrum herbicides.
(D) An organic compound utilized exclusively to accelerate the biochemical fermentation of prebiotic dietary fibers.

2. Which of the following is an accurate statement regarding phytochemicals?
(A) They are essential micronutrients that must be consumed daily for basic human survival and primary energy metabolism.
(B) They are synthetic chemicals produced in commercial laboratories to fortify conventional liquid dairy products.
(C) They are plant-derived bioactive compounds that provide physiological health benefits beyond basic nutritional needs.
(D) They are primary organic metabolites that directly regulate the vital photosynthetic processes in all agronomic crops.

3. Match the phytochemical groups in List I with their major dietary sources in List II.
List I: (Phytochemical Group)
P. Carotenoids
Q. Flavonoids
R. Polyphenols
S. Glucosinolates
List II: (Major Dietary Source)
I. Cruciferous vegetables like broccoli
II. Green tea and dark chocolate
III. Citrus fruits and berries
IV. Carrots and tomatoes
Which of the following is the correct matching?
(A) P-IV, Q-III, R-II, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-II, R-III, S-I
(D) P-III, Q-IV, R-I, S-II

4. Which specific subclass of phytochemicals includes lycopene and lutein?
(A) Glucosinolates
(B) Flavonoids
(C) Plant sterols
(D) Carotenoids

5. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): Glucosinolates in cruciferous vegetables must be hydrolyzed by the enzyme myrosinase to release their bioactive components.
Reason (R): Boiling cruciferous vegetables for extended periods increases the activity of myrosinase, maximizing health benefits.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

6. Which of the following is NOT an established health benefit associated with dietary polyphenol consumption?
(A) Reduction of systemic oxidative stress through direct cellular antioxidant scavenging activity.
(B) Targeted modulation of chronic inflammatory signaling pathways in various human tissues.
(C) Immediate genetic reversal of advanced somatic cell mutations following dietary intake.
(D) Sustained improvement of microvascular endothelial function and overall cardiovascular health.

Click Here to Buy book on Amazon

65. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): Organic farming emphasizes crop rotation and the use of green manures.
Reason (R): These practices are essential to maintain soil fertility and structure without relying on synthetic nitrogen fertilizers.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

66. All of the following pest management strategies are generally permitted in organic farming, EXCEPT:
(A) Introduction of natural predators (biological control)
(B) Use of botanical extracts like neem oil
(C) Application of synthetic organophosphate insecticides
(D) Crop rotation and polyculture

67. Consider the following statements regarding the labelling of organic foods in India under FSSAI regulations:
I. Any food labeled as organic must carry the Jaivik Bharat logo.
II. Organic foods must bear either the FSSAI organic logo or the NPOP/PGS-India mark.
III. Organic status can be claimed even if the farm is in the first month of the conversion period.
IV. Organic food consignments must maintain strict traceability back to the certified farm.
Which of the above statements are correct?
(A) I, II, and IV
(B) I, II, and III
(C) II, III, and IV
(D) I, III, and IV

68. Read the given statements and select the correct option.
Statement I: The "conversion period" is the time required for a conventional farm to transition to organic status, during which full organic practices must be followed.
Statement II: Products harvested during the conversion period can be sold with the standard "Certified Organic" label at premium prices.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

69. Identify the incorrect statement about organic agriculture principles.
(A) It relies heavily on ecological processes, biodiversity, and biological cycles adapted to local environmental conditions.
(B) It isolates agricultural systems from environmental interactions in order to completely prevent physical contamination.
(C) It prioritizes humane treatment, organic feeding, and high animal welfare standards in commercial livestock farming.
(D) It actively seeks to minimize and eliminate all forms of chemical and biological pollution arising from agricultural activities.

70. What is the primary cause-and-effect rationale for establishing "buffer zones" in organic farming?
(A) To completely prevent any possible cross-pollination of certified organic crops by invasive wild weed plant species.
(B) To provide an undisturbed natural sanctuary and habitat exclusively dedicated to harboring large mammalian crop pests.
(C) To minimize the risk of chemical contamination from synthetic pesticide drift originating on adjacent conventional farms.
(D) To capture and recycle excess synthetic nitrogen fertilizers that are intentionally applied to high-value organic crops.

71. Identify the correct pair of standard/concept and its core philosophy in organic farming.
(A) Soil health – Achieved and maintained exclusively through high-dose synthetic chemical NPK fertilizers.
(B) Weed management – Achieved primarily through the routine application of broad-spectrum synthetic herbicides.
(C) Animal husbandry – Maintained via restricted housing spaces and continuous prophylactic antibiotic administration.
(D) Biodiversity – Promoted through systematic mixed cropping, regular crop rotation, and active habitat conservation.

Downloaded from www.pdf.tube

as a standard GMO under recombinant DNA guidelines.
(B) Transgenesis involves introducing a gene from a different, sexually incompatible biological species.
(C) Cisgenesis involves introducing a gene from a sexually compatible, crossable agricultural species.
(D) Gene silencing via RNA interference can be utilized to permanently deactivate undesirable crop traits.

100. What is the cause-and-effect relationship governing the yellow/golden color in Golden Rice?
(A) The application of food-grade yellow chemical dyes to rice seeds during planting causes the harvested grains to physically absorb the color.
(B) The traditional selective cross-breeding of domestic rice varieties with yellow sweet corn produces a genetic hybrid with yellow kernels.
(C) A chronic systemic viral infection within the rice crop paddy causes severe physiological discoloration of the starchy endosperm.
(D) The insertion of genes for phytoene synthase and carotene desaturase enzymes drives endosperm beta-carotene accumulation and yellow coloration.

101. Identify the correct pair of a genetic engineering tool and its function.
(A) Restriction endonuclease – Catalyzes the chemical gluing of different double-stranded DNA fragments together.
(B) Plasmid – Functions as a circular extra-chromosomal vector to carry foreign genetic material into host cells.
(C) DNA ligase – Cleaves and cuts double-stranded DNA molecules at highly specific palindromic recognition sites.
(D) Taq polymerase – Actively degrades single-stranded messenger RNA molecules during cellular transcription phases.

102. What is the appropriate initial analytical step to detect GM sequences in suspected imported crops?
(A) Conduct a formal raw organoleptic sensory evaluation panel to physically taste for the presence of transgenic DNA.
(B) Inspect the outer peel of the fruit to check for the presence of the international Radura food irradiation symbol.
(C) Perform PCR testing at a notified laboratory to detect specific transgenic promoter or terminator sequences.
(D) Quantitatively measure the total ascorbic acid content to determine if the vitamin level is artificially high.

103. What is the primary purpose of introducing the "Roundup Ready" trait into soybeans?
(A) To express insecticidal proteins that render the soy tissues highly toxic to lepidopteran insect pests.
(B) To systematically increase the total storage protein concentration within the market harvested soybeans.
(C) To enable the soy plants to fix ambient atmospheric nitrogen without requiring symbiotic root bacteria.
(D) To allow the soy crop to survive glyphosate herbicide applications, simplifying field-wide weed control.

104. A farmer planting conventional maize is concerned about cross-pollination from a neighboring farm planting GM maize. What is the most practical concept application to mitigate this risk?
(A) Implementing spatial buffer zones and temporal isolation with different planting dates.
(B) Routinely spraying the conventional maize crops with highly concentrated synthetic antibiotics.
(C) Applying heavy agricultural doses of synthetic nitrogen fertilizers to outgrow the GM maize.
(D) Covering the entire physical acreage of the conventional farm with a massive plastic greenhouse.

NODIA

105. Identify the incorrect pair of a GM crop and its prominent engineered trait.
(A) Arctic Apple - Non-browning trait (silencing polyphenol oxidase)
(B) Bt Cotton - Enhanced drought tolerance
(C) AquAdvantage Salmon - Rapid growth (growth hormone gene)
(D) Innate Potato - Reduced acrylamide formation and lower bruising

106. In the safety assessment of GM foods, what does the concept of "Substantial Equivalence" mean?

List II: (Description)
I. Belief that organic farming is better for soil and biodiversity
II. The major barrier limiting the widespread adoption of organic foods
III. Primary driver for purchasing organic foods to avoid pesticide residues
IV. Belief that organic foods taste better than conventional ones

Which of the following is the correct matching?
(A) P-I, Q-III, R-II, S-IV
(B) P-III, Q-II, R-I, S-IV
(C) P-III, Q-I, R-IV, S-II
(D) P-IV, Q-I, R-III, S-II

79. According to several meta-analyses, which nutrient/compound is often found in higher concentrations in organically grown crops compared to conventionally grown ones?
(A) Highly concentrated synthetic nitrates
(B) Active antioxidants and polyphenolics
(C) Total protein content in grain cereals
(D) Toxic heavy metals such as pure cadmium

80. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): Consumers are often willing to pay a premium price for organically certified foods.
Reason (R): Organic foods are perceived as healthier, environmentally friendly, and free from synthetic agrochemical residues.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

81. Which of the following is a common misconception regarding organic foods?
(A) They are completely free from all pathogenic biological hazards like Salmonella or E. coli.
(B) They are cultivated and processed entirely without the use of synthetic chemical pesticides.
(C) They are grown using traditional non-transgenic crops without genetically modified seeds.
(D) Their entire agricultural production process is strictly regulated and certified by third parties.

82. Consider the following statements regarding the market trends for organic foods:
I. The demand for organic foods is increasing globally due to rising health awareness.
II. Organic foods hold a 100% market share in the Indian agricultural sector.
III. E-commerce platforms have significantly boosted the accessibility of organic foods.
IV. High production costs and lower yields contribute to the higher retail price of organic foods.

Which of the above statements are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

83. Read the given statements and select the correct option.
Statement I: Organically grown crops generally have lower levels of nitrate accumulation compared to conventionally grown crops.
Statement II: This lower nitrate level is attributed to the ban on highly soluble synthetic nitrogen fertilizers in organic farming.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

84. Identify the incorrect statement comparing organic and conventional agriculture.
(A) Conventional agriculture typically has higher crop yields per hectare.
(B) Organic agriculture relies heavily on crop rotation to manage soil nutrients.
(C) Conventional agriculture often utilizes genetically modified high-yielding varieties.
(D) Organic farming uses significantly more fossil fuel-based fertilizers than conventional farming.

85. What is the hypothesized cause-and-effect relationship explaining higher phytochemical content in organic crops?
(A) Chemical fertilizers directly introduce synthetic antioxidants into conventional crops, but these molecules evaporate rapidly before harvest.

Click Here to Buy book on Amazon

72. A Food Safety Officer (FSO) is inspecting a retail store selling "100% Organic Honey." What specific documentation/labelling must the FSO check to verify the authenticity of the organic claim under Indian law?
(A) The presence of the official Jaivik Bharat logo along with a valid NPOP/PGS-India certification number.
(B) A signed and hand-written document of organic authenticity provided directly by the local apiary beekeeper.
(C) A standard basic food business registration or licensing number issued under general FSSAI provisions.
(D) Documented customs evidence proving that the raw honey was imported from any certified foreign country.

73. Arrange the chronological sequence of a farm transitioning from conventional to certified organic under NPOP guidelines:
I. Application to an accredited certification body
II. Completion of the mandatory conversion period (usually 24-36 months)
III. Implementation of organic farming practices and cessation of synthetic inputs
IV. Issuance of final "Certified Organic" status
Which of the following represents the correct sequence?
(A) I, III, II, IV
(B) III, I, II, IV
(C) I, II, III, IV
(D) III, II, I, IV

74. A processed food product contains 85% certified organic ingredients and 15% non-organic (but legally permitted) ingredients. How must this product be labeled under typical organic standards (like NPOP)?
(A) It is legally permitted to prominently display the "100% Organic" claim on its main principal display panel.
(B) It can state "Made with organic ingredients" but is prohibited from displaying the main organic certification logo.
(C) It is strictly banned from commercial food sale and distribution within the domestic retail market.
(D) It must be labeled and sold as standard "Conventional Food" with no mention of organic status on the package.

75. Identify the incorrect pair regarding certification logos and their meanings.
(A) Radura - Certified genetically modified organism
(B) Agmark - Agricultural product quality certification in India
(C) Jaivik Bharat - Certified organic food in India
(D) India Organic - Certified organic under NPOP

76. When comparing the nutritional quality of organic versus conventional foods, which statement reflects the most current scientific consensus?
(A) Organic foods consistently display over five hundred percent higher vitamin and mineral concentrations than conventional options.
(B) Conventional agricultural foods completely lack any essential vitamins and minerals due to severe global soil depletion.
(C) While macronutrient profiles are similar, organic crops often contain higher levels of secondary metabolites like polyphenols.
(D) Organic agricultural food products inherently contain zero calories and are metabolized without providing cellular energy.

77. Which of the following statements correctly identifies a key difference in food safety parameters between organic and conventional foods?
(A) Organic foods consistently possess zero pathogenic biological hazards like Salmonella or E. coli compared to standard conventionally grown crops.
(B) Conventional foods are completely immune to fungal mycotoxin contamination, whereas organic crops are highly vulnerable.
(C) Toxic heavy metal accumulation is a safety hazard found exclusively in conventional agronomic crop production systems.
(D) Organic foods generally display significantly lower levels of synthetic chemical pesticide residues than conventional foods.

78. Match the consumer perception factor in List I with its description in List II.
List I: (Consumer Perception Factor)
P. Health consciousness
Q. Environmental concern
R. Organoleptic perception
S. Premium pricing

NODIA

mutations induced by natural solar radiation.

92. Which bacterium is most commonly used as a biological vector to transfer foreign genes into plant cells during the creation of GM crops?
(A) Bacillus subtilis
(B) Escherichia coli
(C) Agrobacterium tumefaciens
(D) Staphylococcus aureus

93. Match the Genetically Modified crop in List I with its primary engineered trait in List II.
List I: (Genetically Modified Crop)
P. Bt Cotton
Q. Golden Rice
R. Roundup Ready Soybeans
S. Flavr Savr Tomato
List II: (Engineered Trait)
I. Herbicide tolerance
II. Insect resistance (bollworm)
III. Delayed ripening/softening
IV. Beta-carotene (Provitamin A) biofortification
Which of the following is the correct matching?
(A) P-IV, Q-II, R-III, S-I
(B) P-II, Q-I, R-IV, S-III
(C) P-I, Q-IV, R-II, S-III
(D) P-II, Q-IV, R-I, S-III

94. What is the specific mechanism of action for the pest resistance trait in Bt crops (like Bt cotton and Bt brinjal)?
(A) The plant produces an artificial chemical insecticide within its vascular tissues that repels all crawling and flying insect species.
(B) The plant genetically grows much thicker structural epidermal leaf cell walls that target insect pests cannot physically chew or bite.
(C) The plant expresses a crystalline Cry protein from Bacillus thuringiensis that is highly toxic to specific insects upon ingestion.
(D) The plant continuously emits volatile volatile pheromone compounds into the atmosphere that permanently sterilize local pest populations.

95. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): Golden Rice was genetically engineered to produce beta-carotene in the endosperm.
Reason (R): Golden Rice was developed primarily to combat Vitamin A deficiency in populations where rice is a staple food.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

96. All of the following are recognized techniques for introducing novel genetic material into plant cells, EXCEPT:
(A) Agrobacterium-mediated transformation
(B) Biolistics (Gene gun)
(C) CRISPR-Cas9 genome editing
(D) Pasteurization

97. Consider the following statements about Bt brinjal:
I. It was engineered to be resistant to the Fruit and Shoot Borer (FSB).
II. It contains the cry1Ac gene from Bacillus thuringiensis.
III. It was the first GM food crop approved for commercial cultivation in India.
IV. Its commercialization in India is currently under a moratorium.
Which of the above statements are correct?
(A) I, II, and IV
(B) I, II, and III
(C) II, III, and IV
(D) I, III, and IV

98. Read the given statements and select the correct option.
Statement I: Recombinant DNA technology allows scientists to isolate a specific gene from one organism and insert it into the genome of a completely unrelated organism.
Statement II: This technique cannot be used to transfer genes between different biological kingdoms (e.g., from bacteria to plants).
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

99. Identify the incorrect statement regarding types of genetic modification.
(A) Mutagenesis via radiation is legally regulated

Downloaded from www.pdf.tube

Assertion (A): There is a persistent ecological concern regarding "gene flow" from GM crops to wild relatives.
Reason (R): The transfer of traits like herbicide tolerance to wild weed populations could create "superweeds" that are difficult to control.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

126. All of the following are potential ecological risks associated with GM crops, EXCEPT:
(A) Harm to non-target organisms (e.g., beneficial insects).
(B) Development of resistance in target pest populations.
(C) Increased depletion of the ozone layer due to GM photosynthesis.
(D) Loss of crop genetic diversity due to monoculture reliance.

127. Consider the following statements regarding the advantages of GM foods:
I. They can be engineered to have a longer shelf life, reducing post-harvest losses.
II. They can be designed to withstand severe environmental stresses like drought or high salinity.
III. They always result in a 100% reduction in the use of all agricultural chemicals.
IV. They can be biofortified to address specific nutrient deficiencies in populations.
Which of the above statements are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

128. Read the given statements and select the correct option.
Statement I: The "terminator technology" (Genetic Use Restriction Technology) involves modifying crops to produce sterile seeds, forcing farmers to buy new seeds every year.
Statement II: Terminator technology is widely used and legally mandated in all GM crops currently cultivated in India.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

129. Identify the incorrect statement regarding herbicide-tolerant (HT) GM crops.
(A) Their use has led to a significant decrease in the overall volume of herbicides applied globally.
(B) They allow farmers to spray broad-spectrum herbicides over the entire field without killing the crop.
(C) They simplify weed management for large-scale industrial farming.
(D) Continuous use of the same herbicide with HT crops exerts selection pressure, leading to herbicide-resistant weeds.

130. What is the cause-and-effect relationship between the widespread, exclusive planting of Bt crops and target pest populations over time?
(A) Target agricultural insect pest populations are completely and permanently eradicated on a global geographical scale.
(B) Overexposed insect pests quickly undergo benign mutations, transforming into highly beneficial agricultural crop pollinators.
(C) Continuous exposure to Bt toxins exerts evolutionary selection pressure, driving the emergence of Bt-resistant pests.
(D) Dietary ingestion of transgenic Bt toxins causes the targeted insect pests to reproduce at a dramatically accelerated rate.

131. Identify the correct pair of a GM-related issue and its specific category.
(A) Oligopoly of multinational seed companies – Ethical and socio-economic concern
(B) Transgenic outcrossing to wild crop relatives – Immediate human nutritional risk
(C) Altered systemic allergenicity profile – Significant crop agronomic advantage
(D) Engineered drought and salinity tolerance – Serious human food safety hazard

132. A Food Safety Officer (FSO) is enforcing labelling regulations on a shipment of imported tortilla chips made from 100% GM corn. The packaging makes no mention of genetic modification. Based on standard consumer right-to-know principles, what is the violation?

NODIA

(A) A transgenic GM food crop must display identical molecular profiles to its conventional parent counterpart in every single chemical cell.
(B) A food that is compositionally and nutritionally similar to an existing food can be managed in the same regulatory manner regarding safety.
(C) Transgenic GM crops must yield equivalent economic and monetary market value to local agricultural growers as conventional crops.
(D) Transgenic food products are characterized as being substantially more toxic and hazardous to human health than conventional foods.

107. Which of the following is a primary consideration when assessing a newly expressed protein in a GM food for potential allergenicity?
(A) Checking the protein's sequence homology to known allergens and its structural resistance to pepsin digestion.
(B) Evaluating through extensive multi-location agronomic trials whether the expressed protein increases the overall crop yield.
(C) Determining through chemical profiling methods whether the novel target protein can be successfully synthesized organically.
(D) Measuring the exact physical dry molecular weight and biological density of the transgenic crop's underground root system.

108. Match the Indian regulatory body in List I with its role regarding GM crops/foods in List II.
List I: (Regulatory Body)
P. IBSC (Institutional Biosafety Committee)
Q. RCGM (Review Committee on Genetic Manipulation)
R. GEAC (Genetic Engineering Appraisal Committee)
S. FSSAI (Food Safety and Standards Authority of India)
List II: (Role)
I. Regulates the safety and labelling of GM foods for human consumption
II. Apex body for approval of large-scale field trials and environmental release of GMOs
III. Monitors ongoing GM research and small-scale field trials
IV. First level of oversight for GM research at the institutional level
Which of the following is the correct matching?
(A) P-I, Q-II, R-III, S-IV
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-I, R-IV, S-III

109. What is a standard method used to assess the potential toxicity of a GM food before it is approved for human consumption?
(A) Conducting long-term human clinical trials with weekends of volunteers eating the raw crop daily.
(B) Injecting purified transgenic crop DNA directly into the systemic blood circulation of primates.
(C) Exposing the final harvested transgenic food crop to extremely high doses of gamma food irradiation.
(D) Conducting standard ninety-day subchronic oral toxicity feeding studies in healthy rodent models.

110. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): A newly expressed protein in a GM food that degrades very rapidly in simulated gastric fluid (pepsin assay) is less likely to be a food allergen.
Reason (R): Most known food allergens are highly stable and resistant to digestion in the acidic environment of the stomach.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

111. Which of the following is NOT a function of the Genetic Engineering Appraisal Committee (GEAC) in India?
(A) Appraising activities involving large scale use of hazardous microorganisms and recombinants.
(B) Setting the Maximum Retail Price (MRP) for seeds of GM crops sold to farmers.
(C) Approving proposals relating to the release of genetically engineered organisms into the environment.
(D) Taking punitive action under the Environment (Protection) Act, 1986 for non-compliance of GM regulations.

112. Consider the following parameters evaluated during the safety assessment of a GM food:

Click Here to Buy book on Amazon

I. Potential for horizontal gene transfer to gut microflora.
II. Unintended pleiotropic effects altering the nutritional profile.
III. Allergenicity of the newly introduced protein.
IV. The aesthetic packaging design of the final retail product.

Which of the above statements are correct?
(A) I, II, and IV
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and III

113. Read the given statements and select the correct option.

Statement I: In India, the FSSAI is legally responsible for regulating the manufacture, storage, distribution, sale, and import of Genetically Modified (GM) foods.

Statement II: The FSSAI acts independently of GEAC when clearing a live GM crop for environmental release and cultivation.

(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

114. Identify the incorrect statement regarding the regulatory framework for GMOs in India.
(A) The primary regulatory rules governing GMOs in India were established under the Environment Protection Act, 1986.
(B) GEAC operates directly under the administrative purview of the Ministry of Environment, Forest and Climate Change.
(C) State governments hold sole authority to approve GM crops, while the central Indian government plays no regulatory role.
(D) RCGM functions as a dedicated regulatory committee within the administrative Department of Biotechnology.

115. What is the potential cause-and-effect risk if a gene from a known allergenic food (like Brazil nut) is transferred to a non-allergenic food (like soybean) without adequate safety testing?
(A) The soybean may express the allergenic protein, triggering severe allergic reactions in individuals sensitive to Brazil nuts.
(B) The transgenic soybean will become highly toxic to all plant insects while remaining entirely safe for human consumption.
(C) The foreign nut gene will cause the transgenic soybean to physically resemble a tree nut, thereby tricking consumers.
(D) The transgenic crop will undergo complete transcriptional silencing, losing its entire natural storage protein content.

116. Identify the correct pair of regulatory concept and its responsible committee in India.
(A) Environmental release of Bt Mustard – Appraised and approved by the Food Safety and Standards Authority of India
(B) Day-to-day monitoring of recombinant research on GMOs – Managed by the Review Committee on Genetic Manipulation
(C) Institutional level bio-safety research oversight – Supervised directly by the national Ministry of Agriculture
(D) Approving import of processed GM soybean oil – Co-regulated by the Genetic Engineering Appraisal Committee and FSSAI

117. A Food Safety Officer (FSO) is reviewing an application for a new GM corn variety intended for food use. The dossier lacks data on the potential toxicity of the specific Cry protein introduced. What is the appropriate regulatory action?
(A) Approve the corn application immediately, as all Bacillus Cry proteins are universally recognized as safe.
(B) Reject the application until specific acute and subchronic toxicity data for the novel protein are submitted.
(C) Approve the transgenic corn but issue a strict legal mandate restricting its commercial use to animal feed.
(D) Conduct an informal organoleptic food taste test with trained panelists to determine general product safety.

118. Which of the following best represents the core principle behind the safety assessment of GM foods by international bodies like the FAO and WHO?
(A) Blanket approval for all GM crops developed by public research institutions.
(B) Complete prohibition of all GM foods due to inherent unmanageable risks.

NODIA

(C) Case-by-case assessment based on scientific principles and risk analysis.
(D) Relying solely on the history of safe use of the recipient organism without testing the new traits.

119. When designing a 90-day rodent feeding study to assess the safety of a GM crop, what is the most critical control group required?
(A) Control rodents fed a completely purified synthetic chemical diet containing zero natural crop elements.
(B) Control rodents fed exclusively on fresh, certified organic fruits grown without any synthetic inputs.
(C) Test rodents receiving direct intravenous injections of the purified transgenic novel protein daily.
(D) Control rodents fed the near-isogenic non-GM counterpart crop cultivated under identical environmental conditions.

120. Identify the incorrect pair regarding safety tests and their targets.
(A) Ames test - Determining the nutritional equivalence of carbohydrates
(B) PCR - Detecting specific modified DNA sequences
(C) ELISA - Detecting and quantifying the newly expressed GM protein
(D) Pepsin resistance assay - Assessing potential allergenicity

121. Under the Food Safety and Standards (Vegan Foods) and proposed GM labelling regulations in India, what defines the threshold for mandatory GM labelling on food packages?
(A) Any detectable presence of transgenic DNA or protein, even at trace levels below 0.01 percent of total food weight.
(B) Specific thresholds (typically 1% or more of GM ingredients) as formally notified and updated by the Food Authority.
(C) Only retail food products that consist of one hundred percent genetically modified raw material require labelling.
(D) Genetically modified food labelling is entirely voluntary and remains at the sole discretion of the manufacturer.

122. Which of the following is a frequently raised ethical concern regarding Genetically Modified crops?
(A) Transgenic crops require significantly larger volumes of agricultural irrigation water compared to conventional crops.
(B) Corporate patenting of GM seeds may lead to food supply monopolization and financial dependency for small farmers.
(C) Genetic modification technologies are utilized exclusively to manufacture high-priced luxury foods, ignoring staple food crops.
(D) The physical process of recombinant gene splicing and transgenic expression inherently violates the fundamental laws of physics.

NODIA

123. Match the potential impact of GM crops in List I with its category in List II.
List I: (Potential Impact)
P. Reduction in broad-spectrum insecticide use (e.g., via Bt Cotton)
Q. Development of "superweeds" resistant to glyphosate
R. Corporate control over patented seed technologies
S. Biofortification of staple crops with Vitamin A
List II: (Category)
I. Environmental disadvantage/risk
II. Socio-economic concern
III. Nutritional advantage
IV. Environmental advantage
Which of the following is the correct matching?
(A) P-IV, Q-I, R-II, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-II, R-I, S-III
(D) P-III, Q-I, R-IV, S-II

124. What happens when highly refined oils are extracted from GM crops (like GM soybean or GM canola)?
(A) The extracted oil becomes highly toxic and chemically unsafe for standard human consumption.
(B) The extracted oil spontaneously converts into harmful trans-fatty acids during storage.
(C) Industrial refining processes remove or destroy transgenic DNA and proteins, leaving the GM origin undetectable.
(D) The extracted oil retains fully intact, biologically active novel proteins that function as systemic enzymes.

125. Identify the correct option based on the assertion and reason statements given below.

(B) Reduced pesticide use exposes organic crops to natural pest pressure, triggering metabolic synthesis of defense-related phytochemicals.
(C) Organic agricultural soils contain specialized biological micro-nutrients that directly transform organic compost into secondary metabolites.
(D) Certified organic growers physically inject purified liquid polyphenols into the vascular tissue of growing crops during late-stage maturation.

86. Identify the correct pair regarding consumer trends in the organic sector.
(A) Mainstream supermarkets - Decreasing their organic product offerings
(B) Trust in certification - The least important factor for consumers
(C) Millennials and Gen Z - Key demographic driving organic food growth
(D) Price elasticity - Organic foods show no drop in demand regardless of price hikes

87. A consumer files a complaint that an organic tomato rotted just as quickly as a conventional tomato, claiming it must be fake. As a food scientist, how would you evaluate this?
(A) The complaint is scientifically valid because authentic, certified organic fresh produce contains natural compounds that completely prevent rot.
(B) Organic certification legally guarantees that the fresh food item will possess an indefinite shelf life without utilizing synthetic preservatives.
(C) The organic tomato must have been secretly subjected to high-dose gamma food irradiation prior to retail distribution in the supermarket.
(D) The rotting is normal, as organic status does not inherently confer resistance to natural microbial spoilage or extended shelf life.

88. Which of the following best explains the primary reason for the higher retail cost of organic foods compared to conventional foods?
(A) Higher labor input requirements, lower average crop yields, and the administrative costs of certification.
(B) The mandatory enrichment of certified organic soils with extremely expensive imported rare earth minerals.
(C) The continuous application of highly priced, patented synthetic pesticide compounds throughout the year.
(D) Excessive government excise taxes and regulatory tariffs levied exclusively on certified organic farm products.

89. A lab report compares two batches of spinach, one organic and one conventional. The conventional batch has 10 ppm of a synthetic pesticide residue (MRL is 15 ppm). The organic batch has 0.1 ppm of the same pesticide. How should this be interpreted under organic application rules?
(A) The organic batch represents an immediate safety hazard and must be declared completely unsafe for human consumption.
(B) The trace residue likely stems from unavoidable environmental pesticide drift, but warrants further operational inspection.
(C) The organic spinach batch is highly fraudulent and represents standard conventional produce relabeled to command premiums.
(D) The conventional spinach batch contains chemical residues that directly violate the established FSSAI legal safety limits.

90. Identify the incorrect pair of market terms related to food production.
(A) Conventional farming - Intensive use of agrochemicals
(B) Biodynamic farming - Exclusive use of genetically modified organisms
(C) Hydroponics - Growing plants in soil-less, nutrient-rich water solutions
(D) Greenwashing - Making false or misleading claims about the environmental benefits of a product

91. What is the precise definition of a Genetically Modified (GM) food crop?
(A) A crop whose DNA has been altered using recombinant technology in a way that does not occur naturally by mating or recombination.
(B) A crop developed selectively over many generations using traditional plant cross-breeding techniques and hybrid selection methods.
(C) A crop cultivated and managed exclusively under certified organic farming protocols without using synthetic agrochemicals.
(D) A crop that has acquired novel phenotypic traits through spontaneous random genetic

Downloaded from www.pdf.tube

(A) Severe product adulteration with dangerous biological pathogens and infectious hazards.
(B) Selling counterfeit organic food products that command unauthorized premium market prices.
(C) Directly violating standard regulatory guidelines governing nutrient content claims on labels.
(D) Misbranding due to the omission of GM labelling, depriving consumers of informed purchasing choice.

133. Which of the following is considered the most significant agronomic disadvantage or risk of prolonged cultivation of identical GM crop clones?
(A) The highly modified crops will eventually revert back to their ancestral state of unproductive wild grasses.
(B) The lack of genetic diversity makes the crop highly vulnerable to new diseases or changing climate conditions.
(C) The transgenic crop leaves will start actively absorbing toxic heavy metals directly from the local atmosphere.
(D) The biological activity of the surrounding farm soil will become completely and permanently sterile in one season.

134. A public advocacy group argues that GM foods are "unnatural" and fundamentally dangerous because humans are "playing God." As a food safety professional addressing these concerns, what is the most scientifically sound approach?
(A) Agree with the advocacy group's stance and recommend banning all modern scientific agricultural practices.
(B) Dismiss public safety concerns as unscientific and emotional hysteria that has no place in policy.
(C) Communicate that safety is evaluated based on rigorous scientific risk assessment of the final food product.
(D) Explain to the public that transgenic modification represents a highly standard certified organic farming technique.

135. Identify the incorrect pair regarding the disadvantages or concerns of GM foods.
(A) Unintended pleiotropic effects - Food Safety concern
(B) Horizontal gene transfer (antibiotic resistance markers) - Medical/Microbial concern
(C) Loss of landraces and traditional varieties - Biodiversity concern
(D) Decreased crop yield potential - Primary reason for farmers adopting GM crops

136. How does "Biofortification" fundamentally differ from basic food fortification?
(A) Biofortification improves the nutrient content of crops during growth using plant breeding, agronomic practices, or biotechnology.
(B) Biofortification involves post-harvest enrichment during processing, whereas basic fortification occurs exclusively in the open field.
(C) Biofortification refers to the post-processing addition of highly concentrated live probiotic cultures to standard dairy foods.
(D) Basic food fortification relies on certified organic ingredients, whereas crop biofortification utilizes synthetic chemical sprays.

137. Under FSSAI regulations, which of the following defines a "Novel Food"?
(A) Any traditional Indian food dish that is prepared utilizing a completely new commercial recipe or culinary preparation technique.
(B) A food without a history of consumption, or made via a new process that significantly alters its nutrition or safety profile.
(C) Any standard commercial food product imported from agricultural producers located outside the geographic Asian continent.
(D) A conventional food product that is enclosed and sold in novel, environmentally friendly, biodegradable packaging materials.

NODIA

138. Match the biofortified crop developed in India in List I with its enhanced nutrient in List II.
List I: (Biofortified Crop)
P. CR Dhan 310 (Rice)
Q. Bhu Sona (Sweet Potato)
R. Pusa Mustard-30
S. Muktaoshri (Rice)
List II: (Enhanced Nutrient)
I. Low Erucic acid
II. High Protein
III. Beta-Carotene
IV. Low Arsenic uptake
Which of the following is the correct matching?
(A) P-III, Q-II, R-IV, S-I
(B) P-II, Q-III, R-I, S-IV

(C) P-I, Q-IV, R-II, S-III
(D) P-IV, Q-I, R-III, S-II

139. Which method of biofortification involves applying mineral fertilizers to the soil or foliar sprays directly onto the leaves of the growing crop?
(A) Agronomic biofortification
(B) Transgenic biofortification
(C) Conventional breeding
(D) Mutagenesis

140. Identify the correct option based on the assertion and reason statements given below.
Assertion (A): Conventional selective breeding is a widely accepted and successful method for biofortifying crops, such as developing iron-rich pearl millet.
Reason (R): Conventional breeding requires the transfer of genes across completely unrelated species using recombinant DNA technology.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

141. All of the following would likely require pre-market approval as a "Novel Food Ingredient" under FSSAI, EXCEPT:
(A) Phytosterols extracted using a newly developed, unproven chemical solvent process.
(B) A synthetic analogue of a botanical extract never before consumed by humans.
(C) Mycoprotein derived from a newly discovered fungal strain.
(D) Standard table salt (Sodium Chloride) mined from a newly opened geological deposit.

142. Consider the following statements regarding FSSAI's regulation of Novel Foods:
I. Prior approval from the Food Authority is mandatory before manufacturing or importing novel foods.
II. Applicants must submit data establishing a history of safe use or comprehensive safety studies.
III. Novel foods are automatically approved if they are legally sold in any other single country.
IV. The safety assessment focuses on toxicity, allergenicity, and nutritional impact.
Which of the above statements are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, II, and IV
(D) I, III, and IV

143. Read the given statements and select the correct option.
Statement I: The concept of "History of Safe Use" implies that a food has been consumed by a significant human population over several generations without adverse health effects.
Statement II: If an ingredient has a documented history of safe use, it is automatically exempt from all hygiene and sanitation regulations during processing.
(A) Statement I is correct, Statement II is incorrect.
(B) Statement I is incorrect, Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

144. Identify the incorrect statement comparing Genetic Modification and Conventional Biofortification.
(A) GM can introduce entirely novel traits not present in the crop's gene pool (e.g., beta-carotene in rice endosperm).
(B) Conventional biofortification relies on the natural genetic variation already existing within crossable species.
(C) Both methods aim to improve the nutritional profile of the crop at the agronomic stage.
(D) GM biofortified crops face far less regulatory scrutiny and public resistance than conventionally biofortified crops.

145. What is the regulatory consequence (cause-and-effect) of a food business operator launching a novel food without obtaining prior approval from FSSAI?
(A) The product is deemed unsafe under the FSS Act, leading to immediate market recall, seizure, and legal prosecution.
(B) The central FSSAI will automatically issue a retrospective regulatory approval to the operator within thirty days.
(C) The food business operator is issued a minor administrative warning but is legally

Click Here to Buy book on Amazon

permitted to continue retail sales.
(D) The unapproved product must be immediately rebranded and marketed as a standard dietary health supplement in retail.

146. Identify the correct pair of a novel food concept and its practical example.
(A) Insect-derived protein – Traditional dietary staple consumed widely in all geographic regions of India for centuries.
(B) Synthetic vitamins – Completely unregulated and strictly banned from use in all commercial human food formulations.
(C) Cultured (Lab-grown) meat – Animal muscle tissue grown in vitro from stem cells inside specialized bioreactors.
(D) Biofortified wheat – A highly regulated genetically modified transgenic crop that is strictly banned worldwide.

147. A Food Safety Officer (FSO) is reviewing an application for a novel food derived from an exotic Amazonian plant. The applicant claims it cures cancer and provides a single 10-person study as proof of safety. Under FSSAI novel food regulations, what is the appropriate evaluation?
(A) Reject the application due to unapproved medical claims and insufficient safety data to prove toxicological safety.
(B) Approve the application immediately because botanical extracts derived from exotic rainforest plants are naturally safe.
(C) Approve the novel food application provisionally for a one-year trial period to monitor potential adverse health reports.
(D) Re-route the application to the national organic certification body to assess if the raw plant was organically grown.

148. Which of the following best distinguishes between GM crops and conventionally biofortified crops in the context of Indian regulations?
(A) Conventionally biofortified crops must be evaluated and cleared by FSSAI's scientific panel on GMOs, whereas GM crops do not require any pre-market clearance.
(B) GM crops require certification from local municipal pesticide boards, whereas conventionally biofortified crops require international environmental approval.
(C) GM crops are exempt from food safety labelling laws in India, whereas conventionally biofortified crops must carry prominent green warning symbols on packages.
(D) GM crops fall under the purview of GEAC for environmental release, while conventionally biofortified crops do not require GEAC appraisal and approval.

149. A food company wants to use an extract from a newly discovered deep-sea algae as a thickening agent. Since it has no history of consumption, what concept application must the company undertake before commercialization?
(A) Submit the raw algal biomass for immediate organic certification under the National Programme for Organic Production.
(B) Conduct complete safety studies and apply to FSSAI for approval under Non-Specified Food Regulations.
(C) Blend the novel algal extract with a widely approved synthetic food additive in order to completely avoid FSSAI detection.
(D) Register and sell the new marine algal extract as a standard traditional Ayurvedic medicine with the Ministry of AYUSH.

150. Identify the incorrect pair regarding food ingredients and their general regulatory status in India.
(A) Curcumin extract from turmeric - Permitted natural coloring/flavoring agent
(B) Rebaudioside A (Stevia extract) - Approved non-nutritive sweetener
(C) Golden Rice - Approved and widely cultivated commercial crop in India
(D) Plant sterol esters - Permitted functional ingredient with specified limits

NODIA

www.nodia.in

ANSWERS

1. (A) A food or food component providing health and medical benefits, including disease prevention or treatment.
Nutraceuticals represent a specialized category of food components that bridge the gap between basic nutrition and pharmaceutical therapeutics. These bioactive compounds are consumed as part of a regular diet or as standardized supplements to promote systemic wellness, reduce the risk of chronic physiological disorders, and actively assist in clinical disease prevention and therapeutic management.

2. (C) They are plant-derived bioactive compounds that provide physiological health benefits beyond basic nutritional needs.
Phytochemicals are naturally occurring bioactive chemical compounds synthesized by plants as secondary metabolites to protect against environmental stressors. In human nutrition, these non-essential dietary components exert significant physiological health benefits, including antioxidant protection, anti-inflammatory effects, and cellular pathway modulation, which actively promote long-term biological wellness beyond the scope of essential vitamins and minerals.

3. (A) P-IV, Q-III, R-II, S-I
Phytochemical groups are systematically categorized by their unique botanical origins and chemical structures. Carotenoids like lycopene abound in tomatoes and carrots, while flavonoids are highly concentrated in vibrant citrus fruits. Polyphenolic catechins are predominantly sourced from green tea and dark chocolate, whereas sulfur-rich glucosinolates are characteristic biological markers of cruciferous vegetables like broccoli.

4. (D) Carotenoids
Lycopene and lutein belong to the carotenoid family, which consists of fat-soluble pigments synthesized by plants, algae, and photosynthetic bacteria. These lipid-soluble tetraterpenoid compounds function as potent biological antioxidants, absorbing excess light energy during photosynthesis in plants and protecting human cellular membranes from systemic oxidative damage, particularly in ocular and cardiovascular tissues.

5. (C) (A) is true but (R) is false.
Glucosinolates require hydrolysis by the endogenous plant enzyme myrosinase to release active, health-promoting isothiocyanates such as sulforaphane. While raw plant tissue damage initiates this biological conversion, extended thermal boiling denatures the heat-sensitive myrosinase protein. Consequently, prolonged cooking inactivates this crucial enzyme, reducing the overall yield of bioactive compounds rather than maximizing their therapeutic benefits.

6. (C) Immediate genetic reversal of advanced somatic cell mutations following dietary intake.
Polyphenols exhibit diverse biological properties that support human health by neutralizing free radicals, reducing systemic inflammation, and improving cardiovascular endothelial function. However, these plant-derived secondary metabolites cannot legally or scientifically claim to perform immediate genetic reversals of advanced somatic cell mutations. Such molecular DNA damage requires complex cellular repair mechanisms beyond basic dietary polyphenol metabolic pathways.

7. (D) I, II, and III
Nutraceuticals are scientifically categorized using multiple taxonomic criteria, including their original food source, physiological mechanism of action, and core chemical structure. However, these functional substances are not classified as Schedule H prescription drugs under Indian food safety regulations. Instead, they are regulated as specialized food supplements to ensure safe consumer access without medical prescriptions.

8. (A) Statement I is correct, Statement II is incorrect.
Flavonoids are water-soluble polyphenolic pigments responsible for the vibrant red, blue, and purple colors of many fruits, vegetables, and flowers. Although they provide exceptional systemic antioxidant benefits, they do not exhibit provitamin A activity in the human digestive system. Provitamin A activity is a specific biochemical trait reserved for carotenoids like beta-carotene.

Downloaded from www.pdf.tube

9. (B) Mechanical processing techniques like milling universally increase the bioaccessibility and bioavailability of all phytochemical classes.
Phytochemical bioavailability is highly dependent on food matrix interactions, lipid co-ingestion, and gut microbiota metabolism. Mechanical processing methods like milling do not universally increase bioavailability for all phytochemical classes. While milling breaks down plant cell walls for certain compounds, it simultaneously exposes sensitive molecules to rapid atmospheric oxidation and thermal degradation, significantly reducing their overall biological activity.

10. (B) Thermal processing disrupts rigid plant cell walls and converts trans-isomers of lycopene to highly bioavailable cis-isomers.
Mild thermal processing of tomatoes enhances lycopene bioavailability through structural and chemical modifications. The heat application effectively disrupts the rigid plant cell walls, releasing the locked carotenoids from the protein-lipid matrix. Additionally, thermal energy drives the cis-trans isomerization of lycopene, converting the naturally occurring trans-isomers into cis-isomers, which are much more easily absorbed in the human intestine.

11. (A) Epigallocatechin gallate (EGCG) – Polyphenolic compound
Epigallocatechin gallate is a major polyphenolic catechin concentrated in green tea leaves, known for its potent antioxidant and anti-inflammatory properties. Conversely, quercetin is a water-soluble flavonoid rather than a lipophilic carotenoid, zeaxanthin is a carotenoid rather than a glucosinolate, and sulforaphane is a sulfur-rich isothiocyanate derivative rather than a polymeric flavonoid compound.

12. (C) The product is misbranded because nutraceuticals cannot legally claim to cure diseases overnight.
Nutraceutical regulations prohibit food business operators from making therapeutic claims that promise to prevent, treat, or cure clinical diseases, especially overnight. Label claims must be scientifically validated, approved by regulatory authorities, and expressed in a non-misleading manner. Marketing a dietary supplement with exaggerated medical claims constitutes misbranding, which violates established national food safety laws.

13. (D) II, I, IV, III
Commercial extraction of phytochemicals begins with harvesting and drying plant raw materials to stabilize the active compounds. Next, solvent extraction is performed to dissolve the target compounds from the matrix. The resulting extract undergoes concentration and solvent removal to yield a crude concentrate, which is finally subjected to chromatographic purification to isolate high-purity bioactive fractions.

14. (C) Phenolic compounds including tocopherols and flavonoids
Phenolic compounds such as tocopherols and flavonoids act as highly effective natural antioxidants in lipid-based systems. Their chemical structure contains hydroxyl groups attached to aromatic rings, which easily donate hydrogen atoms to free radicals. This biochemical reaction effectively terminates lipid autoxidation chain reactions, thereby preventing rancidity and significantly enhancing the oxidative stability of functional food formulations.

15. (B) Phytic acid - Enhances dietary iron absorption
Phytic acid is a well-documented antinutrient found in grains and legumes rather than an enhancer of mineral absorption. It possesses strong chelating properties, binding tightly to dietary iron, zinc, and calcium in the gastrointestinal tract to form insoluble precipitates. This chemical binding severely limits the bioaccessibility and systematic intestinal absorption of these essential minerals in humans.

16. (D) Non-digestible carbohydrates that selectively stimulate the growth, activity, and colonization of beneficial microbial species in the human colon.
Prebiotics are specialized, non-digestible food ingredients, primarily oligosaccharides, that resist hydrolytic enzymatic digestion in the upper gastrointestinal tract. Upon reaching the distal colon, they serve as metabolic substrates that are selectively fermented by beneficial indigenous gut microflora, such as bifidobacteria and lactobacilli. This targeted biological fermentation process actively enhances host metabolic and immunological health.

17. (A) Lactobacillus
Lactobacillus is a widely utilized and scientifically validated genus of Gram-positive, lactic acid-producing bacteria commonly incorporated into functional foods. These beneficial microbes

NODIA

are highly resilient, surviving gastric transit to colonize the human intestinal tract. By producing organic acids and bacteriocins, they inhibit pathogens, support barrier function, and enhance the overall digestive and immunological health of the host.

18. (C) P-II, Q-IV, R-I, S-III
Lipid components possess distinct chemical structures and physiological behaviors in human metabolism. Alpha-linolenic acid is a plant-derived precursor that converts inefficiently to longer-chain omega-3 fatty acids, whereas eicosapentaenoic acid is a marine-sourced anti-inflammatory lipid. Phytosterols lower cholesterol by competing for micellar incorporation in the gut, while trans-fatty acids are strictly regulated due to cardiovascular risks.

19. (A) By competing with cholesterol for absorption in the small intestine.
Phytosterols lower systemic blood cholesterol levels primarily through competitive inhibition within the digestive tract. Because they share a highly similar chemical structure with cholesterol, these plant sterols displace dietary and biliary cholesterol from mixed micelles in the small intestine. This displacement prevents cholesterol from binding to intestinal transporters, thereby reducing its absorption and increasing excretion.

20. (D) (A) is false but (R) is true.
Docosahexaenoic acid is an essential structural lipid found in high concentrations within the brain, retina, and cerebral cortex, supporting vital cognitive and visual functions. However, the human biochemical pathway for converting plant-derived alpha-linolenic acid into docosahexaenoic acid is highly inefficient, typically yielding conversion rates below one percent, which makes direct dietary consumption of marine sources necessary.

21. (B) Steviol glycosides
Inulin, fructooligosaccharides, and galactooligosaccharides are well-established prebiotic dietary fibers that undergo selective fermentation by beneficial gut bacteria in the colon. In contrast, steviol glycosides are high-intensity, non-nutritive natural sweeteners extracted from the Stevia rebaudiana plant. They are utilized primarily as sugar substitutes and do not possess documented prebiotic functional properties in human gut microbiomes.

22. (C) I and III
Omega-3 fatty acids are polyunsaturated lipids defined by a double bond situated at the third carbon atom from the methyl terminus. Marine organisms like microalgae and fatty fish represent the primary dietary sources of active eicosapentaenoic and docosahexaenoic acids. These unsaturated lipids promote anti-inflammatory pathways but are highly susceptible to oxidation due to their multiple double bonds.

23. (A) Statement I is correct, Statement II is incorrect.
Synbiotics are functional formulations combining live probiotics and prebiotic substrates designed to act synergistically. Rather than inhibiting the beneficial microorganisms during gastric transit, the prebiotic component is specifically formulated to serve as a selective nutrient source. This biological support enhances the survival, persistence, and metabolic activity of the co-administered probiotic strain within the host's colon.

24. (A) High water activity and ambient storage uniformly enhance probiotic viability over time.
The formulation of probiotic functional foods requires precise environmental controls to maintain bacterial viability. High water activity and ambient storage temperatures are highly detrimental, rapidly accelerating the death rate of sensitive probiotic cells during product shelf life. Effective formulations rely on low water activity, controlled refrigeration, and advanced microencapsulation techniques to protect strains from environmental degradation.

25. (B) It significantly increases their solubility in lipid matrices.
Free plant sterols possess a highly crystalline structure and extremely low solubility in fats, making their direct incorporation into lipid-rich foods challenging. Esterifying phytosterols with food-grade fatty acids significantly lowers their melting point and increases their solubility in oil and fat matrices. This technological modification allows seamless incorporation into products like functional margarines and spreads.

26. (B) Inulin – Enhances calcium absorption and selectively modulates gut microflora
Inulin is a soluble, fermentable fructan that serves as an effective prebiotic. Upon microbial fermentation in the colon, it produces short-chain

Click Here to Buy book on Amazon

fatty acids that lower the local pH. This acidic environment increases the solubility and passive absorption of dietary calcium. Conversely, cellulose is highly insoluble, lignin is non-fermentable, and pectin supports rather than reduces beneficial probiotic colonization.

27. (A) The product is non-compliant as it fails to deliver the claimed count of viable cells at the end of its shelf life.
Probiotic foods must deliver the physiologically active and legally claimed concentration of viable microflora throughout their entire commercial shelf life. A significant decline in live cell count by the end of the storage period violates labeling compliance and consumer trust. Regulatory authorities deem such products non-compliant, as they fail to guarantee the therapeutic dose promised on the packaging.

28. (C) III, II, I, IV
The physiological pathway for probiotic action begins with the oral ingestion of a viable microbial strain. These microorganisms must then successfully survive the highly acidic gastric environment and digestive bile salts. Upon entering the intestine, the surviving cells adhere to the mucosal lining, allowing them to establish colonization and successfully exclude pathogenic bacteria through competitive inhibition.

29. (D) Utilizing advanced nanoemulsion technology to disperse lipophilic omega-3 fatty acids in an aqueous system without cloudiness.
Formulating a clear, water-based beverage enriched with hydrophobic omega-3 fatty acids requires preventing phase separation and turbidity. Advanced nanoemulsion technology achieves this by reducing lipid droplet sizes to nanometer scales, typically below one hundred nanometers. These ultra-fine droplets do not scatter visible light, keeping the functional beverage visually transparent while ensuring stable, uniform dispersion of the oils.

30. (C) Plant stanols - Osteoporosis
Plant stanols are structurally modified plant sterols specifically targeted at managing hypercholesterolemia and reducing cardiovascular disease risk by blocking intestinal cholesterol absorption. They do not possess any direct therapeutic or physiological link to osteoporosis. Osteoporosis management is instead associated with bone-active nutrients such as calcium, vitamin D, magnesium, and certain soy isoflavones.

31. (B) Foods that inherently contain, or are enriched with, bioactive compounds providing demonstrated physiological benefits beyond basic nutrition.
Functional foods represent conventional dietary items consumed as part of a regular daily diet that deliver target physiological benefits beyond basic nutrition. These products contain inherent or enriched bioactive compounds, such as soluble fibers, phytochemicals, or probiotics, that actively promote systemic health, optimize metabolic functions, and significantly reduce the overall risk of developing chronic diseases.

32. (D) Soluble dietary fiber known as oat beta-glucan
The primary functional constituent in oats responsible for reducing cardiovascular risk is oat beta-glucan, a soluble dietary fiber. Upon ingestion, this viscous polysaccharide forms a thick physical gel in the digestive tract. This gel traps bile acids and dietary cholesterol, preventing their reabsorption and forcing the liver to utilize circulating cholesterol for bile acid synthesis, lowering blood levels.

33. (A) P-III, Q-IV, R-I, S-II
Functional foods contain distinct bioactive constituents that define their physiological properties. Soybeans are rich in phytoestrogenic isoflavones like genistein and daidzein, whereas tomatoes are characterized by the red carotenoid antioxidant lycopene. Green tea owes its health benefits to polyphenolic catechins, specifically epigallocatechin gallate, while whole oats deliver soluble, cholesterol-lowering beta-glucan fibers within their grain structure.

34. (C) Soy
Soybeans are highly recognized in functional nutrition for their high concentration of isoflavones, which are heterocyclic polyphenolic compounds that act as phytoestrogens. Due to their structural similarity to human biological estrogen, these plant-derived compounds can bind weakly to estrogen receptors. This biochemical interaction helps balance hormonal fluctuations, potentially mitigating common menopausal symptoms like hot flashes in women.

Downloaded from www.pdf.tube

53. (A) Statement I is correct, Statement II is incorrect.
Nutrient function claims describe the physiological role of a nutrient in growth, development, and normal bodily functions. However, functional foods in India are strictly prohibited from making therapeutic or curative claims, regardless of whether they contain imported herbs. All health claims must be evaluated and approved by the Food Authority based on rigorous scientific evidence.

54. (C) The addition of synthetic hormones is permitted if justified by an Ayurvedic practitioner.
The regulatory framework for nutraceuticals in India requires ingredients to be listed in permitted schedules, mandates recommended daily usage labels, and requires warnings against replacing a varied diet. However, the addition of synthetic hormones to any food or nutraceutical product is strictly prohibited under FSSAI regulations. This ban is maintained regardless of any external professional justification.

55. (D) The product is deemed non-compliant, legally unsafe, and is subjected to mandatory market recall or heavy penalties.
Launching a nutraceutical product containing an unapproved novel ingredient without FSSAI clearance violates national food safety laws. Under the Food Safety and Standards Act, such products are deemed non-compliant and legally unsafe for public consumption. This status triggers mandatory market recalls, immediate product seizures, and heavy administrative penalties for the non-compliant food business operator.

56. (A) Food for Special Medical Purpose (FSMP) – Specially processed food intended for dietary management of a specific disease.
Food for Special Medical Purpose refers to specially processed foods designed for the dietary management of patients with specific diseases or medical conditions under clinical supervision. Conversely, health supplements are not formulated to cure diseases, novel foods lack a documented history of safe human consumption, and Recommended Dietary Allowance represents the daily nutrient intake sufficient for healthy individuals.

57. (B) Disease risk reduction claim
A label stating that a specific dietary component like oat beta-glucan reduces blood cholesterol constitutes a disease risk reduction claim. This type of claim explicitly links the consumption of a food constituent to a reduced risk of developing a chronic cardiovascular condition. Such claims must be formally evaluated and approved by FSSAI before appearing in retail.

58. (B) IV, II, I, III
The process for securing approval for a new health claim begins with the food business operator formulating the proposed claim. Next, they compile and submit a comprehensive scientific dossier containing clinical trial data. FSSAI's Scientific Panel then reviews this evidence. Finally, the Food Authority issues an official decision of approval or rejection.

59. (A) It must be present at a level to justify the claim, without exceeding the established tolerable upper intake limit or RDA.
To claim calcium enrichment on biscuits under FSSAI regulations, the mineral must be present in sufficient quantities to justify the nutritional claim. However, the total added calcium per recommended daily serving must not exceed the Recommended Dietary Allowance or tolerable upper intake limits. This restriction prevents nutrient toxicity and ensures consumer safety in food formulations.

60. (C) FBO - Functional Botanical Organism
Recommended Dietary Allowance, Food for Special Medical Purpose, and Food for Special Dietary Use are standard regulatory terms in food safety. However, the abbreviation FBO stands for Food Business Operator under the Food Safety and Standards Act. It does not refer to a Functional Botanical Organism, making this pair incorrect within the regulatory framework.

61. (D) Developing an ecological production management system that systematically promotes and enhances biodiversity, biological cycles, and soil health.
The fundamental principle of organic farming centers on developing an ecological production management system. This approach prioritizes natural biological processes over synthetic chemical inputs, aiming to preserve and enhance soil health, protect biodiversity, and sustain biological cycles. It relies on crop rotation, composting, and biological pest management to create a resilient, balanced agricultural ecosystem.

NODIA

44. (C) Incorporating a lipid source like olive oil and applying thermal processing to release lycopene.
Formulating a tomato-based functional food to maximize lycopene absorption requires incorporating a lipid source and applying heat. Thermal processing breaks down the plant cells and converts trans-lycopene into the highly bioavailable cis-isomer. Because lycopene is lipophilic, the co-presence of a healthy fat, such as olive oil, is essential to facilitate micellar incorporation and subsequent intestinal absorption.

45. (D) Epigallocatechin gallate - Fresh tomatoes
Avenanthramides are unique antioxidants found in oats, genistein is a prominent soy isoflavone, and rutin is a key flavonoid in buckwheat. However, epigallocatechin gallate is a major polyphenolic catechin found almost exclusively in the leaves of Camellia sinensis, which are processed into green tea. Fresh tomatoes do not contain this compound, instead being characterized by carotenoids like lycopene.

46. (C) Health claims describe a relationship between a food component and a health condition, whereas nutrient content claims describe the specific concentration level of a nutrient.
Health claims establish a biological relationship between a specific food constituent and a reduction in disease risk or promotion of a physiological function. In contrast, nutrient content claims describe only the concentration level of a specific nutrient present in the food product, using terms such as high, low, or free, without linking it to health outcomes.

47. (B) Special foods formulated with specific bioactive ingredients intended to supplement nutritional intake in a normal diet.
Under FSSAI regulations, nutraceuticals and health supplements represent specialized food products formulated with bioactive ingredients designed to support a normal diet. This regulatory classification excludes infant formulas, standard culinary spices, and raw agricultural commodities. Instead, it focuses on products that provide targeted physiological benefits or supplement daily micronutrient intake within established safe limits.

48. (D) P-III, Q-II, R-I, S-IV
Food labeling claims are regulated based on their specific physiological or nutritional descriptions. Nutrient content claims indicate nutrient concentration levels, such as calling a product a good source of fiber. Disease risk reduction claims link a nutrient, like sodium, to a lower risk of high blood pressure. Physiological function claims describe structural roles, while non-addition claims declare omitted ingredients.

49. (A) Obtaining formal pre-market approval from the Food Authority supported by rigorous and robust scientific clinical data.
Under FSSAI regulations, making a disease risk reduction claim requires food business operators to obtain formal pre-market approval. This authorization process requires submitting a comprehensive scientific dossier containing robust clinical trial data and systematic reviews. The Food Authority evaluates this evidence to ensure the claim is scientifically substantiated and does not mislead consumers.

50. (C) (A) is true but (R) is false.
A label stating a product is high in a vitamin is a nutrient content claim, which describes the concentration level of a nutrient rather than its health effects. Nutrient content claims do not describe physiological or therapeutic roles. Instead, they inform consumers of the quantity of nutrients present per serving, using standardized regulatory descriptors.

51. (A) "Cures severe clinical depression within one week of use."
FSSAI regulations strictly prohibit nutraceutical labels from carrying therapeutic claims that promise to cure, mitigate, or treat any specific medical condition or clinical disease. Overt medical claims, such as curing clinical depression, are reserved exclusively for registered pharmaceutical drugs. Permitted nutraceutical claims must focus solely on supporting physiological functions or maintaining general health and wellness.

52. (D) I, II, and IV
Nutraceuticals must not claim to cure or mitigate diseases, must limit nutrient levels below the Recommended Dietary Allowance, and must carry the prominent warning "NOT FOR MEDICINAL USE". These regulations ensure they are not confused with drugs. Additionally, nutraceuticals are strictly limited to oral administration, and intravenous delivery is prohibited as it falls under medical pharmaceutical regulations.

Click Here to Buy book on Amazon

35. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Regular consumption of tomato products is clinically linked to a reduced risk of prostate cancer due to high concentrations of the antioxidant lycopene. Thermal processing significantly enhances lycopene bioavailability by breaking down rigid plant cell walls and converting the trans-isomers to cis-isomers. This structural transformation maximizes intestinal absorption, allowing the bioactive carotenoid to effectively scavenge cellular free radicals.

36. (D) Anthocyanins
Green tea leaves are rich in monomeric flavan-3-ols, including catechins, epicatechins, and epigallocatechin gallate, which contribute to its potent antioxidant activity. However, green tea does not contain anthocyanins. Anthocyanins are water-soluble vacuolar pigments responsible for the intense red, purple, and blue colors found in berries, grapes, and red cabbage, rather than processed tea leaves.

37. (B) I, II, and IV
Functional foods are conventional dietary products that must be consumed as part of normal meal patterns, rather than as medicinal tablets or capsules. They deliver proven physiological health benefits and can be naturally occurring or technologically formulated. In India, these products are regulated under food safety standards rather than being treated identically to pharmaceutical drugs.

38. (A) Statement I is correct, Statement II is incorrect.
The soluble beta-glucan fiber in oats forms a viscous gel inside the intestinal tract, which physically traps bile acids and limits systemic cholesterol absorption. However, oats do not require genetic modification to synthesize this beneficial compound. Beta-glucan is a naturally occurring structural polysaccharide found inherently in the cell walls of conventional, non-GM oat grains.

39. (D) Functional foods are manufactured and marketed exclusively for treating severe acute clinical diseases in hospitalized patients.
Functional foods are conventional food matrices consumed as part of a normal diet, whereas nutraceuticals are purified compounds sold in medicinal dosage forms. Neither category is designed or marketed exclusively for treating severe acute clinical diseases in hospitalized patients. Instead, both are formulated to support daily physiological health and reduce chronic disease risk in general populations.

40. (A) It contributes to the lowering of total and LDL cholesterol.
Replacing animal protein with soy protein in a balanced diet clinically contributes to the reduction of circulating total and low-density lipoprotein cholesterol levels. The amino acid profile of soy, along with associated bioactive compounds like isoflavones, stimulates hepatic LDL receptor activity. This physiological upregulation enhances the clearance of low-density lipoproteins from the bloodstream, promoting cardiovascular wellness.

41. (B) Soy - Supports cardiovascular health and maintains optimal bone density
Soy is a functional food that supports long-term cardiovascular health and maintains bone density. These benefits are driven by its high-quality protein content, which lowers LDL cholesterol, and its rich concentration of phytoestrogenic isoflavones. These compounds interact with bone estrogen receptors to help slow bone resorption and promote calcium retention, supporting structural skeletal integrity over time.

42. (B) Whether the scientific evidence substantiating the specific health claim is formally evaluated and approved by the Food Authority.
Under Indian food safety regulations, any health claim made on a functional food or beverage must undergo rigorous scientific evaluation. Food business operators cannot make public claims regarding disease risk reduction or physiological functions without formal pre-market assessment and approval by the Food Authority. This ensures that all retail labeling claims are truthful, accurate, and scientifically substantiated.

NODIA

43. (A) II, I, III, IV
The transformation of fresh green tea leaves into black tea begins with plucking. Next, cell wall disruption is performed via rolling to release internal cellular fluids. This step initiates exposure to oxygen, allowing endogenous polyphenol oxidase enzymes to catalyze the oxidation of green catechins into complex cellular polymers. Finally, high-temperature firing halts this enzymatic activity.

62. (C) The deliberate use of genetically modified organisms (GMOs) or transgenic crops is strictly prohibited in organic farming.
Organic food production strictly prohibits the deliberate use of genetically modified organisms or transgenic crops at any stage of cultivation or processing. Furthermore, organic regulations ban high-dose food irradiation and the application of synthetic chemical fertilizers or toxic fungicides. Instead, organic farming relies on natural biological processes and ecological inputs to manage soil fertility and pests.

63. (B) P-III, Q-I, R-II, S-IV
Organic agriculture in India is governed by distinct regulatory frameworks and certification systems. The National Programme for Organic Production establishes third-party export standards, while the Participatory Guarantee System provides local, peer-reviewed group certification. The Jaivik Bharat logo represents the unified organic mark on retail packages, and APEDA serves as the primary implementation agency for NPOP.

64. (D) Organized peer groups of local farmers who ensure mutual regulatory compliance.
The Participatory Guarantee System is a decentralized, locally focused organic certification framework. Instead of hiring expensive, independent third-party commercial auditors, PGS-India relies on peer reviews conducted by organized groups of local farmers. These farmers inspect each other's agricultural fields and management practices, ensuring mutual compliance with organic production standards through shared responsibility and community trust.

65. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Organic farming emphasizes crop rotation and green manures to maintain soil fertility and structure without relying on synthetic nitrogen fertilizers. Rotating crops breaks pest life cycles and introduces different root structures, while green manures return essential organic matter and nutrients to the soil. These ecological practices sustain soil biology and long-term crop productivity naturally.

66. (C) Application of synthetic organophosphate insecticides
Organic agriculture allows diverse ecological pest control strategies, including introducing natural predators, spraying botanical extracts like neem oil, and practicing crop rotation. However, applying synthetic organophosphate insecticides is strictly prohibited. These synthetic neurotoxic chemicals are banned in organic farming because they pose risks of toxic residue accumulation and disrupt beneficial insect populations and soil biology.

67. (A) I, II, and IV
FSSAI regulations require certified organic foods to display the Jaivik Bharat logo and either the NPOP or PGS-India mark. They also require strict traceability back to the origin farm. However, organic status cannot be claimed during the initial conversion period, as the soil and crops require a transitional phase to eliminate synthetic chemical residues.

68. (A) Statement I is correct, Statement II is incorrect.
The conversion period is the transition phase required for a conventional farm to achieve organic status, during which organic management practices must be strictly followed. However, crops harvested during this transitional period cannot be sold as certified organic. They must be marketed as in-conversion products and are prohibited from displaying the official organic certification logo.

69. (B) It isolates agricultural systems from environmental interactions in order to completely prevent physical contamination.
Organic agriculture principles focus on integrating farming systems with natural biological processes rather than isolating them from the environment. These principles emphasize biodiversity, local ecological cycles, and high animal welfare standards while minimizing chemical pollution. By working with nature, organic farms build resilient agroecosystems that sustain soil, crop, and livestock health without relying on synthetic inputs.

70. (C) To minimize the risk of chemical contamination from synthetic pesticide drift originating on adjacent conventional farms.
Buffer zones are physical barriers or strips of land established along the borders of certified organic farms. Their primary purpose is to mitigate the risk of chemical contamination from synthetic pesticide or fertilizer drift originating on adjacent conventional fields. These zones help ensure the

Downloaded from www.pdf.tube

requires higher manual labor for weed and pest management, and generally produces lower crop yields per hectare compared to conventional farming. Additionally, the administrative expenses of maintaining strict compliance and third-party certification add to the overall production costs.

89. (B) The trace residue likely stems from unavoidable environmental pesticide drift, but warrants further operational inspection.
The presence of trace pesticide residues in organic crops does not automatically indicate fraud or safety hazards. In open agricultural systems, small amounts of pesticides can drift from adjacent conventional fields through wind or water. While these low levels are generally permitted if they fall below regulatory thresholds, they warrant operational inspections to ensure organic integrity.

90. (B) Biodynamic farming - Exclusive use of genetically modified organisms
Conventional farming relies on agrochemicals, hydroponics involves soil-less cultivation, and greenwashing refers to misleading environmental claims. Conversely, biodynamic farming is an organic agricultural method that integrates ecological and spiritual principles. It strictly prohibits the use of genetically modified organisms, relying instead on specialized herbal preparations and astronomical planting calendars to manage soil and crops.

91. (A) A crop whose DNA has been altered using recombinant technology in a way that does not occur naturally by mating or recombination.
A genetically modified crop is defined by the alteration of its genetic material using recombinant DNA technology. This genetic modification involves introducing, removing, or rearranging specific nucleotide sequences in a laboratory setting to express desired traits. This process achieves genetic changes that do not occur naturally through conventional cross-breeding, hybrid selection, or spontaneous mutations.

92. (C) Agrobacterium tumefaciens
Agrobacterium tumefaciens is a soil bacterium widely utilized as a biological vector to transfer foreign genetic material into plant genomes. In nature, it transfers a specific DNA segment into host plant cells, causing crown gall disease. Scientists exploit this natural gene transfer mechanism by replacing disease-causing genes with target genes, creating genetically modified crops.

93. (D) P-II, Q-IV, R-I, S-III
Genetically modified crops are engineered to express specific functional traits. Bt cotton contains bacterial genes providing targeted resistance against the destructive bollworm, while Golden Rice is biofortified with beta-carotene to produce provitamin A in the endosperm. Roundup Ready soybeans are modified to tolerate glyphosate herbicides, and Flavr Savr tomatoes utilize gene silencing to delay fruit softening.

NODIA

94. (C) The plant expresses a crystalline Cry protein from Bacillus thuringiensis that is highly toxic to specific insects upon ingestion.
Bt crops are engineered to express crystalline Cry proteins derived from the soil bacterium Bacillus thuringiensis. When target insect pests feed on the plant tissues, they ingest these proteins. The alkaline environment of the insect's midgut activates the toxin, which binds to specific receptors, creating pores that disrupt osmotic balance and lead to death.

95. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Golden Rice was genetically engineered to synthesize beta-carotene within its starchy endosperm, giving the grains a characteristic yellow hue. This biofortification was developed to address severe vitamin A deficiencies in developing nations where rice is a dietary staple. By providing dietary provitamin A, Golden Rice serves as a sustainable biotechnological intervention to support public health.

96. (D) Pasteurization
Introducing novel genetic material into plant cells relies on advanced molecular biology techniques. These include Agrobacterium-mediated transformation, biolistics using a gene gun, and CRISPR-Cas9 genome editing. Conversely, pasteurization is a mild thermal preservation process used to destroy pathogenic microorganisms in liquid foods. It does not alter genetic structures or introduce foreign DNA into living plant cells.

97. (A) I, II, and IV
Bt brinjal was engineered with the cry1Ac gene from Bacillus thuringiensis to provide targeted resistance against the destructive fruit and shoot

nitrates and pesticide residues. This nutritional difference is attributed to the exclusion of highly soluble synthetic fertilizers and chemical crop protection, which stimulates natural plant defense mechanisms.

80. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Consumers are often willing to pay premium prices for organically certified foods because they perceive them as healthier, environmentally friendly, and free from synthetic agrochemicals. This willingness to pay is driven by a focus on personal wellness and ecological sustainability. These consumer motivations justify the higher market prices associated with organic certification and production.

81. (A) They are completely free from all pathogenic biological hazards like Salmonella or E. coli.
A common misconception is that organic foods are entirely free from pathogenic biological hazards like Salmonella or E. coli. While organic farming avoids synthetic chemical pesticides, organic crops remain vulnerable to natural microbial contamination from manure, water, or wildlife. Consequently, organic foods require the same rigorous hygiene, sanitation, and food safety controls as conventional crops.

82. (C) I, III, and IV
The global organic food market is growing due to rising health awareness, and e-commerce platforms have significantly improved consumer accessibility. Additionally, high production costs and lower average yields contribute to premium retail prices. However, organic foods do not hold a one hundred percent market share in India, where conventional agriculture remains the dominant production system.

83. (C) Both Statement I and Statement II are correct.
Organically grown crops generally exhibit lower levels of nitrate accumulation than conventionally grown crops. This difference is directly linked to the prohibition of highly soluble synthetic nitrogen fertilizers in organic farming. Instead, organic systems utilize slow-release organic nitrogen from compost and green manure, which prevents plants from absorbing and accumulating excessive nitrates in their tissues.

84. (D) Organic farming uses significantly more fossil fuel-based fertilizers than conventional farming.
Conventional agriculture typically achieves higher crop yields per hectare and often utilizes genetically modified varieties. It also relies heavily on synthetic agrochemicals. In contrast, organic farming strictly prohibits the use of fossil fuel-based synthetic chemical fertilizers. Instead, organic systems utilize natural biological nitrogen fixation, animal manures, and compost to sustain soil fertility and crop growth.

85. (B) Reduced pesticide use exposes organic crops to natural pest pressure, triggering metabolic synthesis of defense-related phytochemicals.
The elevated level of phytochemicals in organic crops is explained by a natural biological response to environmental stress. Because organic farming avoids synthetic chemical pesticides, crops are exposed to low-level pest and pathogen pressures. This exposure triggers the plant's defense mechanisms, stimulating the metabolic synthesis of secondary metabolites like polyphenols and flavonoids to protect itself.

86. (C) Millennials and Gen Z - Key demographic driving organic food growth
Millennials and Generation Z represent the key consumer demographics driving the rapid growth of the organic food sector. These younger consumers demonstrate high health consciousness, strong environmental concerns, and a preference for sustainable food production. Conversely, supermarkets are expanding their organic offerings, trust in certification is critical, and organic demand remains sensitive to price hikes.

87. (D) The rotting is normal, as organic status does not inherently confer resistance to natural microbial spoilage or extended shelf life.
Organic certification verifies the ecological methods used to grow a crop, but it does not alter the plant's natural biological characteristics. Organically grown tomatoes rot at a similar rate to conventional tomatoes because they are subject to the same post-harvest physiological degradation and microbial spoilage. Organic status does not provide resistance to natural decay.

88. (A) Higher labor input requirements, lower average crop yields, and the administrative costs of certification.
The premium retail cost of organic foods is driven by several economic factors. Organic farming

Click Here to Buy book on Amazon

integrity of organic crops by preventing accidental exposure to non-permitted chemical inputs.

71. (D) Biodiversity – Promoted through systematic mixed cropping, regular crop rotation, and active habitat conservation.
In organic farming, soil health is sustained via organic matter, weed control is achieved manually or mechanically, and livestock is raised humanely without prophylactic antibiotics. Conversely, agricultural biodiversity is promoted through mixed cropping, systematic crop rotations, and active habitat conservation. These practices create a balanced, resilient farm ecosystem that naturally suppresses pests and supports ecological health.

72. (A) The presence of the official Jaivik Bharat logo along with a valid NPOP/PGS-India certification number.
To verify the authenticity of a product marketed as organic in India, a Food Safety Officer must check the label for the official Jaivik Bharat logo. The package must also display a valid certification number issued under either NPOP or PGS-India. This verification ensures the product has undergone conformity assessment and complies with national organic standards.

73. (B) III, I, II, IV
The transition from conventional to certified organic farming begins with implementing organic practices and ceasing synthetic inputs. Next, the farmer applies to an accredited certification body. The farm must then complete the mandatory conversion period under inspection. Finally, after verifying compliance with NPOP standards, the certification body issues the final organic certification.

74. (B) It can state "Made with organic ingredients" but is prohibited from displaying the main organic certification logo.
Under NPOP guidelines, processed foods containing between seventy and ninety-five percent certified organic ingredients cannot be labeled as fully organic. They are permitted to state "Made with organic ingredients" on the packaging but are strictly prohibited from displaying the official organic certification logo. This restriction prevents misleading claims and maintains high standards for organic certification.

75. (A) Radura - Certified genetically modified organism
Agmark certifies agricultural quality in India, Jaivik Bharat represents certified organic food, and India Organic denotes compliance with NPOP standards. However, the Radura symbol is an international logo used to indicate that a food product has been treated with ionizing radiation. It does not signify that a food is a certified genetically modified organism.

76. (C) While macronutrient profiles are similar, organic crops often contain higher levels of secondary metabolites like polyphenols.
Scientific consensus indicates that organic and conventional crops display highly similar macronutrient profiles, such as total carbohydrates, proteins, and fats. However, because organic crops are grown without synthetic pesticides, they face natural environmental and pest pressures. This exposure triggers the synthesis of defense-related secondary metabolites, resulting in higher levels of beneficial polyphenols and antioxidants.

77. (D) Organic foods generally display significantly lower levels of synthetic chemical pesticide residues than conventional foods.
A key food safety benefit of organic agriculture is that organic foods contain significantly lower levels of synthetic chemical pesticide residues compared to conventional crops. However, neither farming system is completely immune to biological hazards like Salmonella or fungal mycotoxins. Both systems require strict post-harvest hygiene and quality control to prevent microbial contamination.

78. (C) P-III, Q-I, R-IV, S-II
Consumer purchasing behavior in the organic sector is driven by multiple overlapping perceptions. Health-conscious consumers buy organic to avoid synthetic pesticide residues, while environmental concerns reflect a desire to protect soil and biodiversity. Organoleptic perceptions involve the belief that organic foods taste better, whereas premium pricing remains the primary economic barrier to widespread consumer adoption.

79. (B) Active antioxidants and polyphenolics
Meta-analyses of comparative crop studies demonstrate that organically grown crops consistently contain higher concentrations of active antioxidants and polyphenolic compounds. Conversely, they exhibit lower levels of synthetic

NODIA

borer. While it demonstrated high efficacy, its commercial cultivation in India remains under an indefinite moratorium due to environmental and biosafety concerns. Consequently, it was not the first GM crop approved for Indian cultivation.

98. (A) Statement I is correct, Statement II is incorrect.
Recombinant DNA technology enables scientists to isolate a target gene from one organism and integrate it into the genome of an unrelated species. This molecular technique easily crosses taxonomic boundaries, allowing gene transfers between different biological kingdoms, such as expressing bacterial insecticidal proteins in agricultural plants. This capability forms the basis of transgenic crop development.

99. (A) Mutagenesis via radiation is legally regulated as a standard GMO under recombinant DNA guidelines.
Transgenesis introduces genes from different species, cisgenesis uses genes from sexually compatible species, and RNA interference is used for targeted gene silencing. However, random mutagenesis induced by physical radiation or chemical exposure is not regulated as a genetically modified organism. Because it does not involve recombinant DNA technology, mutagenized crops are treated under conventional breeding frameworks.

100. (D) The insertion of genes for phytoene synthase and carotene desaturase enzymes drives endosperm beta-carotene accumulation and yellow coloration.
The characteristic golden color of Golden Rice is driven by genetic engineering of the carotenoid biosynthetic pathway. Introducing genes for phytoene synthase from daffodil and carotene desaturase from a soil bacterium allows the rice endosperm to produce beta-carotene. This carotenoid accumulation turns the normally white starchy endosperm yellow, providing a source of provitamin A.

101. (B) Plasmid – Functions as a circular extra-chromosomal vector to carry foreign genetic material into host cells.
In genetic engineering, plasmids are small, circular, extra-chromosomal DNA molecules that function as vectors to transport foreign genetic material into host cells. Conversely, restriction endonucleases cleave DNA at specific palindromic sequences, DNA ligases catalyze the joining of DNA fragments, and Taq polymerase synthesizes complementary DNA strands during the polymerase chain reaction process.

102. (C) Perform PCR testing at a notified laboratory to detect specific transgenic promoter or terminator sequences.
Detecting genetically modified sequences in imported crops requires sensitive molecular analysis, as transgenic modifications cannot be identified through sensory evaluation or nutritional testing. Performing polymerase chain reaction assays at a certified laboratory allows analysts to amplify and detect specific genetic markers, such as the 35S promoter or NOS terminator sequences, confirming the presence of GM material.

103. (D) To allow the soy crop to survive glyphosate herbicide applications, simplifying field-wide weed control.
The Roundup Ready trait is introduced into soybeans to confer tolerance to the broad-spectrum herbicide glyphosate. This modification involves expressing a bacterial gene encoding a glyphosate-resistant form of the EPSPS enzyme. Consequently, farmers can apply the herbicide across fields to eliminate weeds without damaging the modified soy crop, simplifying large-scale agricultural weed management.

104. (A) Implementing spatial buffer zones and temporal isolation with different planting dates.
Preventing cross-pollination between genetically modified and conventional crops requires implementing strict agricultural isolation strategies. Conventional growers can use spatial buffer zones to separate their fields from GM crops, or practice temporal isolation by scheduling different planting dates. These agronomic methods ensure that the crops do not flower simultaneously, significantly reducing the risk of windborne transgenic pollen transfer.

105. (B) Bt Cotton - Enhanced drought tolerance
Arctic Apples are modified to prevent enzymatic browning, AquAdvantage Salmon is engineered for rapid growth, and Innate Potatoes produce less acrylamide when heated. However, Bt cotton is engineered with bacterial cry genes to provide resistance against insect pests like the bollworm. It does not possess genetic modifications designed

NODIA

to enhance drought tolerance or other abiotic stress resistances.

106. (B) A food that is compositionally and nutritionally similar to an existing food can be managed in the same regulatory manner regarding safety.
The concept of substantial equivalence is a guiding principle in the safety assessment of genetically modified foods. It posits that if a GM food is compositionally and nutritionally similar to its conventional counterpart, it can be regulated in the same manner. This comparison focuses on macronutrients, micronutrients, and known toxins to identify any unintended safety issues.

107. (A) Checking the protein's sequence homology to known allergens and its structural resistance to pepsin digestion.
Assessing the allergenicity of a newly expressed protein in a GM food involves evaluating its structural stability and sequence similarity to known allergens. Scientists compare the protein's amino acid sequence against database registries of documented allergens. Additionally, they perform pepsin resistance assays to determine if the protein degrades rapidly in simulated gastric fluids, as stable proteins are more likely to trigger allergic responses.

108. (C) P-IV, Q-III, R-II, S-I
India's biotechnology regulatory framework involves multiple committees with distinct roles. Institutional Biosafety Committees provide the first level of oversight within research organizations, while the Review Committee on Genetic Manipulation monitors ongoing laboratory research. The Genetic Engineering Appraisal Committee approves environmental releases, and FSSAI regulates the safety and labeling of GM foods for human consumption.

109. (D) Conducting standard ninety-day subchronic oral toxicity feeding studies in healthy rodent models.
Evaluating the toxicological safety of GM crops involves conducting standardized animal feeding studies before commercial approval. Researchers perform ninety-day subchronic oral toxicity studies using healthy rodent models, where the test group is fed diets containing the GM crop. This allows monitoring for adverse physiological effects, organ toxicity, or clinical abnormalities compared to control groups.

110. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
A newly expressed protein in a GM food that degrades rapidly in simulated gastric fluid is less likely to act as a food allergen. This is because most known food allergens are structurally stable and resist enzymatic digestion in the stomach, allowing them to reach the intestinal mucosa intact and trigger immune reactions. Rapid digestion minimizes systemic exposure.

111. (B) Setting the Maximum Retail Price (MRP) for seeds of GM crops sold to farmers.
The Genetic Engineering Appraisal Committee is responsible for appraising the environmental release of GMOs, regulating large-scale use of hazardous microbes, and taking punitive actions under environmental laws. However, GEAC does not possess the authority to set the Maximum Retail Price for GM seeds. Seed pricing and royalty caps are managed by agricultural and pricing control ministries.

112. (D) I, II, and III
Evaluating the safety of GM foods involves assessing potential horizontal gene transfer to gut microbes, unintended nutritional alterations from pleiotropic effects, and the allergenicity of newly expressed proteins. These assessments focus strictly on biological safety and toxicological parameters. Conversely, the aesthetic design of retail packaging is not a scientific parameter considered during biosafety evaluations.

113. (A) Statement I is correct, Statement II is incorrect.
FSSAI is the statutory authority responsible for regulating the manufacture, storage, sale, and import of GM foods for human consumption in India. However, FSSAI does not act independently of GEAC regarding environmental releases. GEAC remains the primary statutory body responsible for appraising and approving the environmental release and commercial cultivation of live GM crops.

114. (C) State governments hold sole authority to approve GM crops, while the central Indian government plays no regulatory role.
India's biotechnology regulations were established under the Environment Protection Act, with GEAC operating under the Ministry of Environment and RCGM functioning within the Department of Biotechnology. The central

Downloaded from www.pdf.tube

government retains regulatory authority over GMO approvals, and state governments do not hold sole power. States instead manage local implementation and cultivate consent within their territories.

115. (A) The soybean may express the allergenic protein, triggering severe allergic reactions in individuals sensitive to Brazil nuts.
Transferring a gene encoding an allergenic protein from a Brazil nut to a soybean can cause the transgenic soybean to express that specific allergen. If consumed, this modified soybean can trigger severe allergic reactions in individuals who are sensitive to Brazil nuts. This highlights the critical importance of evaluating protein homology and allergenicity during GM safety assessments.

116. (D) Approving import of processed GM soybean oil – Co-regulated by the Genetic Engineering Appraisal Committee and FSSAI
The regulation of GM foods in India involves shared responsibilities among regulatory bodies. The import of processed GM soybean oil is co-regulated by GEAC, which appraises environmental risks, and FSSAI, which ensures food safety and labeling compliance. Conversely, laboratory research is monitored by RCGM, and institutional oversight is managed by local Institutional Biosafety Committees.

117. (B) Reject the application until specific acute and subchronic toxicity data for the novel protein are submitted.
If a regulatory dossier for a new GM crop lacks critical toxicological data, the Food Safety Officer must reject the application. Regulatory approval cannot be granted without evidence establishing the safety of newly expressed proteins. The applicant must submit data from acute and subchronic toxicity studies to demonstrate that the novel protein poses no risk to human health.

118. (C) Case-by-case assessment based on scientific principles and risk analysis.
International bodies like the FAO and WHO advocate for a case-by-case scientific risk assessment to evaluate the safety of GM foods. Because different genetic modifications introduce unique proteins and traits, safety cannot be evaluated under a single blanket approval or ban. Each transgenic food must be individually assessed for potential toxicity, allergenicity, and nutritional equivalence.

119. (D) Control rodents fed the near-isogenic non-GM counterpart crop cultivated under identical environmental conditions.
Designing a ninety-day rodent feeding study to assess GM food safety requires a control group fed a near-isogenic non-GM counterpart crop. This control crop must be cultivated under identical environmental conditions to minimize confounding variables. This comparison allows researchers to isolate and identify any physiological effects caused specifically by the genetic modification rather than environmental or agronomic differences.

120. (A) Ames test - Determining the nutritional equivalence of carbohydrates
PCR assays are used to detect modified DNA sequences, ELISA tests quantify expressed proteins, and pepsin resistance assays evaluate potential allergenicity. However, the Ames test is a biological assay used to assess the mutagenic potential of chemical compounds rather than determining the nutritional equivalence of carbohydrates. This makes it an incorrect pair for carbohydrate nutritional analysis.

121. (B) Specific thresholds (typically 1% or more of GM ingredients) as formally notified and updated by the Food Authority.
Mandatory GM labeling on food packages in India is governed by specific tolerance thresholds established by the Food Authority. If the concentration of GM ingredients in a food product exceeds these designated thresholds, such as one percent or more, the package must carry a prominent GM label. This threshold balance supports consumer transparency while accommodating trace, unintentional contamination.

122. (B) Corporate patenting of GM seeds may lead to food supply monopolization and financial dependency for small farmers.
Ethical concerns surrounding GM crops often focus on the socio-economic impacts of biotechnology. The corporate patenting of transgenic seed technologies allows companies to restrict seed-saving, raising concerns about food supply monopolization. This patent control can lead to financial dependency for smallholder farmers, who must purchase expensive, patented seeds and matching chemical inputs every season.

NODIA

to select and propagate plants with naturally higher nutrient levels.

141. (D) Standard table salt (Sodium Chloride) mined from a newly opened geological deposit.
Novel food regulations apply to substances with no history of safe consumption or those produced via unproven chemical processes. This includes newly extracted phytosterols, synthetic botanical analogues, and novel mycoproteins. Conversely, standard sodium chloride mined from a new geological deposit is not a novel ingredient, as table salt has a long, documented history of safe dietary use.

142. (C) I, II, and IV
FSSAI's novel food regulations mandate prior approval before manufacture or import, requiring applicants to submit safety, allergenicity, and toxicity data. However, novel foods are not automatically approved in India simply because they are sold in other countries. FSSAI conducts independent safety evaluations tailored to Indian dietary patterns and populations before granting market clearance.

143. (A) Statement I is correct, Statement II is incorrect.
A history of safe use indicates that a food has been consumed by a significant population over several generations without documented adverse health effects. However, having a history of safe use does not exempt a food business from hygiene and sanitation standards. All food processing operations must comply with established safety and sanitary practices to prevent post-harvest contamination.

144. (D) GM biofortified crops face far less regulatory scrutiny and public resistance than conventionally biofortified crops.
Both genetic modification and conventional biofortification aim to improve crop nutrient profiles, but they rely on different methods. While GM can introduce entirely novel traits, conventional breeding utilizes existing genetic variation. However, GM crops face significantly higher regulatory scrutiny, safety testing requirements, and public resistance than conventionally bred crops, which are generally accepted by consumers.

145. (A) The product is deemed unsafe under the FSS Act, leading to immediate market recall, seizure, and legal prosecution.
Launching a novel food product without obtaining prior approval from FSSAI violates national food safety regulations. Under the FSS Act, unapproved novel foods are deemed non-compliant and unsafe for public consumption. This status leads to immediate product seizures, mandatory market recalls, and legal prosecution or heavy administrative penalties for the responsible food business operator.

146. (C) Cultured (Lab-grown) meat – Animal muscle tissue grown in vitro from stem cells inside specialized bioreactors.
Cultured meat is a novel food concept involving the in vitro cultivation of animal muscle tissue from stem cells inside bioreactors, bypassing traditional animal rearing. Conversely, insect-derived protein is not a traditional dietary staple in India, synthetic vitamins are heavily regulated but permitted in food, and biofortified wheat is not a banned transgenic crop.

147. (A) Reject the application due to unapproved medical claims and insufficient safety data to prove toxicological safety.
When reviewing an application for a novel food with unapproved medical claims and insufficient safety data, the Food Safety Officer must reject it. FSSAI regulations prohibit food products from claiming to cure diseases like cancer. Furthermore, a single small-scale study is insufficient to establish toxicological safety, requiring extensive safety and allergenicity evaluations.

148. (D) GM crops fall under the purview of GEAC for environmental release, while conventionally biofortified crops do not require GEAC appraisal and approval.
In India, GM crops require environmental appraisal and approval from GEAC before field trials or environmental release. In contrast, conventionally biofortified crops are developed through traditional plant breeding methods and do not involve recombinant DNA technology. Consequently, they do not fall under the purview of GEAC or require transgenic biosafety approvals.

Click Here to Buy book on Amazon

132. (D) Misbranding due to the omission of GM labelling, depriving consumers of informed purchasing choice.
Selling imported food products containing ingredients derived from GM crops without disclosure constitutes misbranding under food safety regulations. Failing to declare the GM origin of ingredients deprives consumers of their right to make informed purchasing choices. Regulatory authorities mandate clear labeling to ensure market transparency and uphold consumer rights regarding food composition.

133. (B) The lack of genetic diversity makes the crop highly vulnerable to new diseases or changing climate conditions.
A significant agronomic risk of planting genetically identical crop clones over large areas is the loss of genetic diversity. Monocultures are highly vulnerable to environmental changes, as a single new disease, pest mutation, or climate extreme can devastate the entire crop. Maintaining genetic diversity is essential to ensure long-term agricultural resilience and food security.

134. (C) Communicate that safety is evaluated based on rigorous scientific risk assessment of the final food product.
Addressing public concerns regarding GM foods requires communicating that safety is evaluated through scientific risk assessments. Regulatory bodies do not base approvals on opinions or assumptions. Instead, they require data on toxicology, allergenicity, and nutritional equivalence to ensure that approved GM foods are as safe as their conventional counterparts, addressing public concerns objectively.

135. (D) Decreased crop yield potential - Primary reason for farmers adopting GM crops
Unintended pleiotropic effects, horizontal gene transfer, and the loss of traditional landraces represent valid safety and biodiversity concerns associated with GM crops. However, decreased yield potential is not a reason for farmer adoption. Farmers adopt GM crops because they offer advantages such as insect resistance, simplified weed management, and higher effective yields through reduced pest damage.

136. (A) Biofortification improves the nutrient content of crops during growth using plant breeding, agronomic practices, or biotechnology.
Biofortification is the process of increasing the nutritional value of food crops during their agronomic growth phase. This is achieved through conventional plant breeding, targeted agronomic fertilization practices, or genetic modification. In contrast, basic food fortification involves adding micronutrients to processed foods, such as salt or milk, post-harvest during industrial manufacturing.

137. (B) A food without a history of consumption, or made via a new process that significantly alters its nutrition or safety profile.
Under FSSAI regulations, a novel food is defined as an ingredient or food product that does not have a documented history of safe consumption in India. It also includes foods produced through newly developed technological processes that significantly alter their nutritional composition, physical structure, or safety profile, requiring a comprehensive scientific assessment before commercial sale.

138. (B) P-II, Q-III, R-I, S-IV
India has developed several biofortified crop varieties to address specific nutritional needs. CR Dhan 310 is a rice variety biofortified with higher protein content, and Bhu Sona is a sweet potato rich in beta-carotene. Pusa Mustard-30 contains low levels of erucic acid, while Muktaoshri is a specialized rice variety engineered for low arsenic uptake from contaminated soils.

139. (A) Agronomic biofortification
Agronomic biofortification involves applying mineral-rich fertilizers directly to the soil or spraying them onto plant leaves during crop growth. This practice temporarily increases the accumulation of essential micronutrients, such as zinc, selenium, or iodine, in the edible parts of the harvest. It does not alter the plant's genome or rely on genetic selection.

140. (C) (A) is true but (R) is false.
Conventional selective breeding is an effective and accepted method for biofortifying crops, such as developing iron-rich pearl millet. However, this process does not involve recombinant DNA technology or gene transfer across unrelated species. Instead, breeders cross-pollinate sexually compatible varieties within the same crop species

NODIA

123. (A) P-IV, Q-I, R-II, S-III
The impacts of GM crops span environmental, socio-economic, and nutritional dimensions. Reducing chemical pesticide use through insect-resistant Bt crops represents an environmental advantage, whereas the development of glyphosate-resistant weeds is an environmental risk. Corporate control of patented seeds constitutes a socio-economic concern, while biofortifying staple crops like rice with beta-carotene provides a distinct nutritional advantage.

124. (C) Industrial refining processes remove or destroy transgenic DNA and proteins, leaving the GM origin undetectable.
When edible oils are extracted and highly refined from GM crops like soybeans or canola, industrial processing steps, including degumming, neutralizing, bleaching, and deodorizing, remove almost all cellular materials. This extensive refining process degrades and removes transgenic DNA and proteins. Consequently, the final refined oil contains no detectable GM material, making it compositionally identical to conventional oil.

125. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Gene flow from GM crops to wild relatives represents an environmental risk in agricultural biotechnology. When herbicide-tolerant crops cross-pollinate with related wild weed species, they can transfer the tolerance traits to the wild populations. This transfer can drive the emergence of herbicide-resistant weeds, which are difficult to manage and require more aggressive weed control strategies.

126. (C) Increased depletion of the ozone layer due to GM photosynthesis.
Ecological risks of GM crops include potential harm to non-target beneficial insects, the development of resistance in target pest populations, and a loss of genetic diversity due to monoculture reliance. However, GM crops do not cause ozone layer depletion. Photo-synthetic pathways in transgenic plants operate similarly to conventional crops and do not release ozone-depleting substances.

127. (B) I, II, and IV
Genetically modified foods offer benefits such as extending shelf life to reduce post-harvest losses, enhancing tolerance to environmental stresses like drought, and biofortifying crops with essential micronutrients. However, they do not guarantee a complete reduction in all agricultural chemical use. Certain modifications, like herbicide tolerance, can lead to increased applications of specific herbicides over time.

128. (A) Statement I is correct, Statement II is incorrect.
Terminator technology involves modifying crops to produce sterile seeds at harvest, preventing farmers from saving and replanting seeds and forcing them to purchase new stock annually. However, this technology is not used or legally permitted in India. Indian regulations prohibit the registration and commercial cultivation of any GM crop varieties containing genetic use restriction technologies.

129. (A) Their use has led to a significant decrease in the overall volume of herbicides applied globally.
Herbicide-tolerant crops simplify weed management by allowing broad-spectrum herbicides to be applied over entire fields without damaging the crop. However, their widespread adoption has not decreased overall herbicide volumes. Instead, continuous cultivation has led to increased applications of herbicides like glyphosate, which exerts selection pressure and drives the emergence of herbicide-resistant weed populations.

130. (C) Continuous exposure to Bt toxins exerts evolutionary selection pressure, driving the emergence of Bt-resistant pests.
The continuous, large-scale cultivation of Bt crops exerts strong evolutionary selection pressure on target insect populations. Over time, individuals with natural genetic resistance to the Bt toxin survive and reproduce, passing these resistant traits to their offspring. This process leads to the emergence of resistant pest populations, reducing the long-term efficacy of Bt crop technologies.

131. (A) Oligopoly of multinational seed companies – Ethical and socio-economic concern
The consolidation of seed markets by a few multinational corporations represents a socio-economic concern, as it can limit choices and increase seed costs for farmers. Conversely, gene flow to wild relatives is an ecological risk rather than a nutritional one, allergenicity is a health concern, and environmental stress tolerance is an agronomic benefit rather than a food hazard.

Downloaded from www.pdf.tube

149. (B) Conduct complete safety studies and apply to FSSAI for approval under Non-Specified Food Regulations.
Using an extract from a newly discovered deep-sea algae with no history of human consumption requires obtaining regulatory approval before commercial use. The food company must conduct comprehensive safety, toxicity, and allergenicity studies. They must then apply to FSSAI for approval under the regulations for non-specified food and food ingredients to ensure consumer safety.

150. (C) Golden Rice - Approved and widely cultivated commercial crop in India
Curcumin extract, stevia-derived rebaudioside A, and plant sterol esters are approved food ingredients within specified regulatory limits in India. However, Golden Rice is not an approved or cultivated commercial crop in the country. To date, Bt cotton remains the only genetically modified crop officially approved for commercial cultivation within Indian agricultural systems.

www.nodia.in

NODIA

(C) Grant immediate approval of the batch if the baker presents a commercial receipt for natural beetroot juice extract.
(D) Collect representative samples for confirmatory laboratory analysis using High-Performance Liquid Chromatography (HPLC).

16. Consider the following statements regarding the stability and properties of betalains and curcumin:
I. Betalains are nitrogen-containing plant pigments found predominantly in beetroot.
II. Betalains undergo dramatic reversible colour changes from red to blue when pH shifts from 3 to 7.
III. Curcumin is highly stable to light and alkaline conditions.
IV. Curcumin exhibits antioxidant and anti-inflammatory health benefits.
Which of the given statements are correct?
(A) I and II
(B) II and III
(C) I and IV
(D) III and IV

17. Which synthetic dye is notoriously linked to the "Southampton Six" study regarding its potential to exacerbate hyperactivity in children when combined with sodium benzoate?
(A) Brilliant Blue FCF
(B) Tartrazine
(C) Fast Green FCF
(D) Titanium Dioxide

18. Which of the following statements about approved synthetic colours and their ADI values is incorrect?
(A) ADI is expressed in milligrams of the additive per kilogram of body weight per day.
(B) ADI represents the amount of food colour that can be consumed daily over a lifetime without appreciable health risk.
(C) Exceeding the ADI on a single day does not necessarily imply acute toxicity.
(D) The ADI for Sunset Yellow is uniform globally and remains independent of toxicological re-evaluations.

19. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The use of artificial synthetic colours is totally prohibited in specific food categories such as fresh produce, raw meat, and infant foods.
Reason (R): These categories are considered staple or critical nutritional sources, and the addition of colours may deceive consumers regarding freshness or quality.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

20. Which of the following precisely defines Caramel Colour Class IV according to international food additive standards?
(A) Caramel produced by heating carbohydrates without any ammonium or sulfite compounds.
(B) Caramel produced by heating carbohydrates in the presence of sulfite compounds but without ammonium compounds.
(C) Caramel produced by heating carbohydrates in the presence of both sulfite and ammonium compounds.
(D) Caramel produced by heating carbohydrates in the presence of ammonium compounds but without sulfite compounds.

21. A beverage manufacturer wants to formulate an acidic cola drink (pH 2.5) that requires a stable brown colour resistant to fading in light. Which specific colourant should be applied to prevent precipitation?
(A) Caramel Class IV
(B) Caramel Class I
(C) Caramel Class III
(D) Curcumin microemulsion

22. Match the Synthetic Colour in List I with its corresponding E-number in List II:
List I: (Synthetic Colour)
P. Tartrazine
Q. Sunset Yellow FCF
R. Carmoisine
S. Brilliant Blue FCF
List II: (E-number)
I. E133
II. E122
III. E110
IV. E102
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II

Click Here to Buy book on Amazon

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

II. Magnesium-porphyrin complex
III. Nitrogen-containing water-soluble pigment
IV. Tetraterpene hydrocarbon
(A) P-IV, Q-II, R-I, S-III
(B) P-IV, Q-I, R-II, S-III
(C) P-II, Q-IV, R-I, S-III
(D) P-III, Q-II, R-I, S-IV

8. Which of the following represents a correct pair regarding the structural property of chlorophylls?
(A) Chlorophyll a - Contains a formyl group instead of a methyl group at position 3.
(B) Chlorophyll b - Contains a methyl group instead of a formyl group at position 3.
(C) Pheophytin - Forms when the central magnesium ion is replaced by two hydrogen atoms.
(D) Pheophorbide - Forms when the phytol tail is cleaved from the pheophytin molecule.

9. What is the primary cause of the undesirable olive-brown colour formation in green vegetables during thermal processing?
(A) Thermal oxidation of beta-carotene and other carotenoids triggered by high-temperature processing.`
(B) Rapid enzymatic browning catalyzed by active polyphenol oxidase under elevated processing temperatures.`
(C) Chemical interaction between anthocyanins and trivalent metal ions leached from processing equipment.`
(D) Acidic displacement of the central magnesium ion in chlorophyll by hydrogen ions to form pheophytin.`

10. Arrange the following steps in the correct order to represent the sequential degradation pathway of chlorophyll during acidic and thermal processing of green vegetables:
I. Formation of Pheophorbide
II. Intact Chlorophyll
III. Loss of phytol chain
IV. Loss of central magnesium ion to form Pheophytin
(A) II, III, IV, I
(B) II, IV, III, I
(C) II, IV, I, III
(D) II, I, IV, III

11. Given below are two statements:
Statement I: Anthocyanins are highly sensitive to pH variations, typically appearing red in acidic conditions and blue or green in alkaline conditions.
Statement II: The stability of anthocyanins is generally unaffected by the presence of oxygen, ascorbic acid, or metal ions.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

12. Which of the following pigments is an exception and does NOT belong to the category of water-soluble natural colouring agents?
(A) Betanin
(B) Curcumin
(C) Cyanidin-3-glucoside
(D) Delphinidin

13. What is the best and most appropriate justification for strictly monitoring the Acceptable Daily Intake (ADI) of synthetic food colours?
(A) Chronic intake above ADI is linked to potential carcinogenicity, hyperactivity in children, and severe allergic reactions.
(B) They possess extremely low tinctorial strength, requiring massive concentrations to achieve any acceptable color hue.
(C) They undergo rapid chemical degradation into highly toxic heavy metal compounds during standard human digestive processes.
(D) They systematically inhibit the metabolic absorption of essential fat-soluble vitamins throughout the small intestine.

14. Which of the following constitutes an incorrect pair regarding the synthetic colour and its typical shade?
(A) Tartrazine - Lemon Yellow
(B) Sunset Yellow - Orange-Yellow
(C) Carmoisine - Blue
(D) Erythrosine - Cherry Red

15. A food safety officer inspects a batch of red velvet cake and suspects the use of a non-permitted synthetic dye instead of the declared natural colour. Which action is most appropriate?
(A) Condemn the entire production batch immediately based solely on a subjective visual assessment of the red color intensity.
(B) Instruct the baker to artificially increase the cake's pH to test for the physical presence of anthocyanins on-site.

Downloaded from www.pdf.tube

CHAPTER 06
Colouring and Flavouring Agents

1. Consider the following statements regarding the classification and properties of natural colouring agents:
I. Natural colours are generally more stable to heat and light than synthetic colours.
II. Carotenoids are fat-soluble pigments responsible for yellow, orange, and red colours.
III. Anthocyanins exhibit structural changes and colour variations strictly dependent on the pH of the medium.
IV. Betalains are highly sensitive to pH changes between pH 3 and 7, similar to anthocyanins.
Which of the given statements are correct?
(A) I and II
(B) II and III
(C) I, II, and III
(D) III and IV

2. Which of the following natural carotenoids is primarily responsible for the characteristic red colour of ripe tomatoes and watermelons?
(A) Lutein
(B) Zeaxanthin
(C) Beta-carotene
(D) Lycopene

3. Which of the following statements incorrectly describes the role of colour in food acceptability?
(A) Colour serves as an absolute indicator of the nutritional density of all processed foods.
(B) Colour creates psychological expectations regarding the flavour and quality of the food.
(C) The natural colour of food can indicate the degree of ripeness or spoilage.
(D) Loss of natural colour during processing negatively impacts consumer perception and marketability.

4. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Beta-carotene exhibits high stability in aqueous solutions but rapidly degrades in lipid environments.
Reason (R): Beta-carotene is a highly unsaturated hydrocarbon that is completely insoluble in water and undergoes oxidation when exposed to light and oxygen.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

5. Which of the following best defines "nature-identical flavouring substances"?
(A) Artificially synthesized compounds that are chemically identical to flavorings found naturally in plants or animals.
(B) Naturally extracted compounds obtained from herbs, spices, and essential oils using physical and enzymatic methods.
(C) Synthetic aromatic agents that mimic natural flavors but possess completely unique structures not found in nature.
(D) Non-aromatic chemical enhancers like monosodium glutamate that intensify the flavor profiles inherent in foods.

NODIA

6. A food technologist wants to fortify a lipid-based beverage with a natural pigment that also provides protection against macular degeneration. Which of the following pigments is the most appropriate choice?
(A) Anthocyanin
(B) Chlorophyllin
(C) Betanin
(D) Lutein

7. Match the Natural Pigment in List I with its primary chemical nature or source in List II:
List I: (Natural Pigment)
P. Beta-carotene
Q. Chlorophyll
R. Anthocyanin
S. Betalain
List II: (Chemical Nature/Source)
I. Water-soluble flavonoid

(C) P-IV, Q-II, R-III, S-I
(D) P-I, Q-II, R-III, S-IV

23. Which of the following represents a correct pair of an artificial flavouring agent and its primary aromatic profile?
(A) Diacetyl - Green apple
(B) Ethyl maltol - Sweet, cotton candy-like
(C) Vanillin - Smoky, roasted meat
(D) Isoamyl acetate - Butter

24. What is the primary cause of the controversial health concern related to Caramel Class III and IV, leading to strict regulatory limits?
(A) Generation of acrylamide due to high-temperature carbohydrate degradation.
(B) Residual sulfur dioxide causing acute asthmatic reactions.
(C) Formation of 4-methylimidazole (4-MEI) during the ammoniation process.
(D) Precipitation of heavy metals during the cooling phase of caramelization.

25. A patient experiences headaches, sweating, facial pressure, and numbness after eating heavily seasoned restaurant food. Which food additive is traditionally linked to this "Chinese Restaurant Syndrome"?
(A) Disodium guanylate
(B) Tartrazine
(C) Diacetyl
(D) Monosodium glutamate

26. Given below are two statements:
Statement I: Natural flavouring substances are exclusively derived from plant or animal raw materials by physical, microbiological, or enzymatic processes.
Statement II: Artificial flavouring agents possess chemical structures that are identical to those found naturally in foods but are synthesized chemically.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

27. Which of the following is an exception and is NOT considered a flavour enhancer?
(A) Monosodium glutamate
(B) Ethyl butyrate
(C) Disodium inosinate
(D) Disodium guanylate

28. Which of the following best describes the fundamental mechanism by which Disodium Inosinate and Disodium Guanylate operate in food formulations?
(A) They provide a strong, standalone salty taste that replaces sodium chloride.
(B) They act synergistically with Monosodium Glutamate to intensely amplify the umami taste.
(C) They mask the bitter notes of synthetic colours in pharmaceutical syrups.
(D) They undergo the Maillard reaction at room temperature to produce roasted flavours.

29. Which of the following is an incorrect pair regarding the flavour development process and its prerequisite?
(A) Strecker degradation - Requires lipid oxidation and high moisture content.
(B) Maillard reaction - Requires a reducing sugar and an amino acid.
(C) Caramelisation - Requires sugars and high temperatures, without the need for amino acids.
(D) Enzymatic browning - Requires polyphenol oxidase, oxygen, and phenolic compounds.

30. A food manufacturing facility wants to reduce the sodium content of its soup powder while maintaining the perceived saltiness and savoury profile. Which formulation strategy should be employed?
(A) Increase the sucrose content to balance the lack of salt.
(B) Add artificial vanillin to enhance the olfactive perception of salt.
(C) Replace 50% of NaCl with Monosodium Glutamate and Disodium Inosinate.
(D) Utilize Caramel Class II to darken the soup, masking the flavour loss.

31. Consider the following statements regarding the Maillard reaction and caramelisation:
I. Both the Maillard reaction and caramelisation are forms of non-enzymatic browning.
II. The Maillard reaction typically occurs at lower temperatures than caramelisation.
III. Caramelisation specifically involves the degradation of amino acids at high heat.
IV. The Maillard reaction produces melanoidins, which contribute to the brown colour of baked bread.
Which of the given statements are correct?

Click Here to Buy book on Amazon

Which of the given statements are correct?
(A) I, II, and IV
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and III

47. In food processing, what specific natural alternative is increasingly being utilized to replace the synthetic red dye Carmoisine in dairy and confectionery products?
(A) Curcumin extract powder
(B) Spirulina algae extract
(C) Caramel Class I pigment
(D) Red cabbage anthocyanins

48. Which of the following statements incorrectly outlines a principle of the Maillard reaction?
(A) It initiates via a condensation reaction between a free amino group and an active reducing sugar.
(B) It directly results in the nutritional loss of essential amino acids, most notably L-lysine.
(C) The reaction rate decreases exponentially as the water activity reaches the range of 0.6 to 0.8.
(D) High processing temperatures and slightly alkaline pH levels strongly favor reaction progress.

49. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Spices like turmeric and saffron are preferred in traditional cooking not only for their flavour but also for their natural colouring properties.
Reason (R): These spices contain synthetic azo dyes naturally synthesized within their plant tissues during maturation.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

50. Which definition accurately describes "Flavour Reversion" in the context of food science?
(A) The physical extraction of aromatic volatile oils from botanical raw materials using steam distillation.
(B) The laboratory synthesis of complex flavor formulations starting from simple nature-identical precursors.
(C) The chemical conversion of brown polymeric melanoidins back into individual reducing monosaccharide sugars.
(D) The development of off-flavors in refined lipids due to mild oxidation prior to the onset of true rancidity.

51. A beverage company extracts natural blue pigment from spirulina. However, during pasteurization, the blue colour degrades into a dull grey. Which concept explains this processing failure?
(A) It contains phycocyanin, a protein-based pigment that denatures irreversibly during heating.
(B) It relies on complex magnesium ions that rapidly precipitate out of solution at high heat.
(C) The molecular structure undergoes rapid lipid-type oxidation upon exposure to pasteurizing heat.
(D) The phycocyanin pigment requires a highly acidic pH of 2.0 to maintain any physical stability.

52. Match the Flavour Enhancer or Compound in List I with its distinctive characteristic in List II:
List I: (Flavour Enhancer/Compound)
P. Monosodium Glutamate
Q. Maltol
R. Diacetyl
S. Vanillin
List II: (Characteristic)
I. Imparts a sweet, caramel-like aroma, often used in baked goods
II. The primary compound responsible for artificial vanilla flavour
III. Enhances umami taste, derived from glutamic acid
IV. A volatile compound posing an inhalation hazard to workers
(A) P-III, Q-I, R-IV, S-II
(B) P-III, Q-II, R-IV, S-I
(C) P-IV, Q-I, R-III, S-II
(D) P-I, Q-III, R-II, S-IV

53. Which of the following represents a correct pair of a natural flavouring agent and its primary active chemical constituent?
(A) Mint - Menthol
(B) Lemon - Eugenol
(C) Garlic - Piperine

NODIA

39. What is the direct physical effect of prolonged exposure to high-intensity light on Riboflavin when used as a yellow food colour in clear glass milk bottles?
(A) It rapidly polymerizes into dark brown melanoidin complexes under normal storage.
(B) It undergoes photo-oxidation, generating off-flavors known as "sunlight flavor."
(C) It enhances the sweet sensory profile of milk by degrading lactose molecules.
(D) It converts chemically into a highly toxic class of synthetic azo dye compounds.

40. If laboratory tests on brightly coloured yellow sweets reveal the presence of Metanil Yellow, what is its legal status and primary health concern?
(A) Permitted food additive up to 100 ppm that causes minor allergic skin reactions.
(B) Permitted natural extract which is certified safe for consumption across all ages.
(C) Non-permitted industrial dye linked to testicular damage and systemic carcinogenicity.
(D) Non-permitted nature-identical chemical agent causing immediate fatal anaphylaxis.

41. Given below are two statements:
Statement I: The Codex Alimentarius Commission establishes international standards for food additives, including safe limits for colouring and flavouring agents.
Statement II: Food safety regulations mandate that if an artificial flavour is added to a food product, the label must declare it as "Contains Artificial Flavouring Substances."
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

42. Which of the following processing treatments is an exception because it does NOT significantly accelerate the degradation of natural anthocyanin pigments?
(A) Holding at freezing temperatures (-18°C) in the dark
(B) High-temperature short-time (HTST) pasteurisation
(C) Exposure to oxygen
(D) Addition of sulfur dioxide (sulfiting)

43. Which of the following represents the most effective commercial strategy to stabilize chlorophyll in thermally processed green peas?
(A) Extended blanching at extremely low processing temperatures to reduce cellular cell wall pressure.
(B) Addition of magnesium or zinc salts to form highly stable metallo-chlorophyll complexes.
(C) Thermal processing of the green peas in a heavily buffered and highly acidic brine solution.
(D) Total replacement of cooking water with high-fructose corn syrup prior to the retort stage.

44. Which of the following constitutes an incorrect pair of a flavour compound and the chemical process that primarily generates it?
(A) Acrylamide - Maillard reaction
(B) Diacetyl - Caramelisation of pure sucrose
(C) Pyrazines - Roasting/Maillard reaction
(D) Allicin - Enzymatic cleavage in crushed garlic

45. From a food safety compliance perspective, what is the ruling on using monosodium glutamate (MSG) in a food product line designated specifically for infants?
(A) Issue a non-compliance report as MSG is strictly prohibited in foods intended for infants below 12 months.
(B) Approve the use, provided MSG does not exceed 1% of the total formulation.
(C) Approve the use, provided the label states "Contains Umami Flavour."
(D) Request the company to switch from MSG to Disodium Inosinate, which is freely permitted in infant formulas.

46. Consider the following statements regarding the stability of colouring agents during food processing:
I. Tartrazine is highly stable to heat and light, making it suitable for baked goods.
II. Betacyanins are heat-sensitive and undergo degradation during prolonged thermal processing.
III. Chlorophyll is highly stable in acidic environments, retaining its bright green colour.
IV. Lycopene undergoes isomerisation from trans to cis forms upon heating, which can increase its bioavailability.

Downloaded from www.pdf.tube

if extracted using solvent extraction.
III. MSG addition requires a warning label stating "Not recommended for infants below 12 months."
IV. If a product contains both natural and artificial flavours, it must be declared as containing "Nature-Identical Flavours."
Which of the given statements are correct?
(A) I and III
(B) I, II, and III
(C) II and IV
(D) I, III, and IV

62. Which naturally occurring flavour compound is primarily responsible for the characteristic pungent and pungent-sweet aroma of garlic?
(A) Sinigrin
(B) Piperine
(C) Allicin
(D) Capsaicin

63. Which of the following statements incorrectly characterizes nature-identical flavouring substances?
(A) They are synthesized in a laboratory.
(B) They have a chemical structure identical to substances found in nature.
(C) They often cost less to produce at an industrial scale than extracting the natural equivalent.
(D) They contain novel chemical bonds that the human digestive system cannot metabolize.

64. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The Maillard reaction is intentionally promoted in the production of roasted coffee and baked bread.
Reason (R): The Maillard reaction produces melanoidins and a complex array of pyrazines and furans that impart desirable brown colour and rich flavours.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

65. How is "Acceptable Daily Intake" (ADI) precisely defined?
(A) The maximum permitted concentration of a specific food additive legally allowed within a single food serving.
(B) The daily intake level of an additive over a lifetime that presents no appreciable health risk to consumers.
(C) The exact median lethal dose (LD50) required to cause acute toxicity in half of the test animal population.
(D) The absolute minimum quantity of a colorant needed to generate a visible visual hue in an aqueous medium.

NODIA

66. If a manufacturer replaces sucrose with a high-intensity non-reducing sweetener (such as sucralose) in a cake recipe, what will be the outcome regarding flavour and colour development during baking?
(A) The baked cake will undergo accelerated non-enzymatic caramelization driven by the high relative sweetness of sucralose.
(B) The cake structure will darken rapidly because synthetic sucralose acts as a direct chemical catalyst for enzymatic browning.
(C) The overall flavor profile will remain identical to the control recipe as heat alone generates aromatic baking pyrazines.
(D) The cake will be much paler and lack baked flavors because the Maillard reaction requires a reactive reducing sugar.

67. Match the Encapsulation Technique in List I with its brief description in List II:
List I: (Encapsulation Technique)
P. Spray Drying
Q. Coacervation
R. Extrusion
S. Freeze Drying
List II: (Description)
I. Emulsion is forced through a die into a dehydrating liquid or gas
II. Phase separation of one or more hydrocolloids from a solution
III. Atomization of an emulsion into a hot gaseous medium
IV. Sublimation of frozen solvent under vacuum
(A) P-III, Q-II, R-I, S-IV
(B) P-III, Q-I, R-II, S-IV
(C) P-IV, Q-II, R-I, S-III
(D) P-II, Q-III, R-I, S-IV

68. Which of the following represents a correct pair regarding a natural pigment and its specific health benefit documented in scientific literature?

(D) Chilli - Cinnamaldehyde

54. What is the direct effect of adding an alkaline substance (like baking soda) to water when boiling green vegetables like broccoli?
(A) It accelerates the conversion of chlorophyll into pheophytin, turning the vegetables brown.
(B) It induces the complete chemical degradation and rapid precipitation of lipophilic carotenoids.
(C) It neutralizes all inherent volatile flavor compounds, rendering the boiled vegetable tasteless.
(D) It preserves the bright green color by preventing the loss of central magnesium from chlorophyll.

55. A food manufacturer faces an issue where the natural anthocyanin extract used to colour a fruit beverage shifts from red to an unappealing blue-purple shade. What is the most likely cause?
(A) The beverage was accidentally formulated with excessive citric acid.
(B) The water used for the formulation had a highly alkaline pH.
(C) The beverage was stored at a temperature below freezing.
(D) The beverage lacks sufficient artificial preservatives.

56. Given below are two statements:
Statement I: The use of essential oils as flavouring agents provides concentrated aromatic profiles but can introduce stability issues due to their volatility and susceptibility to oxidation.
Statement II: Encapsulation of essential oils using spray drying utilizes wall materials that are entirely insoluble in water to ensure slow release in the human stomach.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

57. Which of the following synthetic colours is an exception because it belongs to the triarylmethane class rather than the azo dye class?
(A) Tartrazine
(B) Sunset Yellow
(C) Carmoisine
(D) Brilliant Blue FCF

58. What is the most comprehensive method to analyze a complex food matrix for the simultaneous presence of multiple unapproved synthetic dyes?
(A) High-Performance Liquid Chromatography (HPLC) coupled with a Diode Array Detector (DAD).
(B) Volumetric acid-base titration of the food matrix utilizing a standardized strong chemical acid.
(C) Direct Ultraviolet-Visible (UV-Vis) spectrophotometric analysis without any prior separation steps.
(D) High-precision automated refractometry to measure changes in refractive index of the extract.

59. Which of the following constitutes an incorrect pair of a food colour category and its typical maximum regulatory limit?
(A) Synthetic food colour in solid food - Generally 100 ppm (up to 200 ppm in some specific foods)
(B) Synthetic food colour in canned peas - 1000 ppm
(C) Natural colours - Good Manufacturing Practices (GMP) limits
(D) Tartrazine in flavoured milk - 100 ppm

60. A manufacturer is formulating a clean-label strawberry yogurt and requires an intense red colour. Artificial colours are prohibited, and carmine (cochineal) is rejected for vegetarian compliance. What is the most scientifically sound solution?
(A) Add a high dosage of synthetic Erythrosine dye which naturally contains inorganic iodine.
(B) Incorporate a beetroot juice concentrate (betalains) while avoiding high thermal processing.
(C) Utilize a highly alkaline chemical extraction of plant chlorophyll to yield a deep red color.
(D) Add Caramel Class IV colorant to mimic the characteristic dark red shades of ripe strawberries.

61. Consider the following statements regarding food labelling regulations for colours and flavours:
I. If a food contains permitted synthetic colours, the label must display a specific declaration.
II. Natural flavours require the prefix “Artificial”

Click Here to Buy book on Amazon

(A) I, II, and IV
(B) I, III, and IV
(C) II and III
(D) I and IV

32. What is the characteristic flavour profile most commonly associated with the chemical compound diacetyl?
(A) Ripe banana
(B) Bitter almond
(C) Buttery
(D) Citrus

33. Which of the following statements about the encapsulation of flavours is incorrect?
(A) Encapsulation protects volatile flavor compounds from chemical oxidation and thermal degradation.
(B) Encapsulation guarantees permanent flavor retention, completely preventing volatile loss over a decade.
(C) Spray drying represents the most widely implemented industrial technique for uniform flavor encapsulation.
(D) Common wall carrier materials for encapsulation include maltodextrins, gum arabic, and modified starches.

34. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The Maillard reaction is highly favourable in extremely acidic food environments (pH < 3).
Reason (R): The protonation of the amino group of amino acids in acidic conditions accelerates the nucleophilic attack on the carbonyl group of reducing sugars.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) Both A and R are false.

35. How are "clean-label" colours defined in recent food regulatory contexts?
(A) Natural source pigments requiring minimal processing and utilizing consumer-friendly ingredients.
(B) Chemical dyes that undergo industrial bleaching to appear completely clear in food formulations.
(C) Purified synthetic colorants processed to remove heavy metal contaminants below standard limits.
(D) High-purity artificial dyes engineered to leave no trace residue on clean-in-place equipment.

36. A manufacturer is producing a dry beverage mix containing volatile citrus essential oils. To prevent oxidation and flavour loss during the product's 12-month shelf life, which technological application is most critical?
(A) Emulsification with polysorbate 80
(B) Addition of Caramel Class I for UV protection
(C) Microencapsulation using spray drying with gum arabic
(D) Storage in a transparent, oxygen-permeable pouch

37. Match the Analytical Method in List I with its primary application for detecting colours/ flavours in List II:
List I: (Analytical Method)
P. HPLC (High-Performance Liquid Chromatography)
Q. Gas Chromatography - Mass Spectrometry (GC-MS)
R. Spectrophotometry
S. Thin Layer Chromatography (TLC)
List II: (Primary Application)
I. Rapid, qualitative screening of synthetic dyes
II. Quantitative analysis of non-volatile synthetic colours
III. Identification and quantification of volatile flavour compounds
IV. Measuring absorbance to determine total anthocyanin content
(A) P-II, Q-III, R-IV, S-I
(B) P-III, Q-II, R-IV, S-I
(C) P-II, Q-IV, R-III, S-I
(D) P-I, Q-III, R-IV, S-II

38. Which of the following represents a correct pair regarding a flavouring agent and its natural botanical source?
(A) Vanillin - Clove oil
(B) Eugenol - Vanilla bean
(C) Menthol - Black pepper
(D) Cinnamaldehyde - Cinnamon bark

NODIA

(A) Lycopene - Prevention of clinical vitamin C deficiency and scurvy
(B) Chlorophyll - Direct therapeutic cure for type-1 juvenile diabetes
(C) Lutein - Protection against age-related macular degeneration
(D) Betanin - Dynamic enhancement of skeletal bone tissue calcification

69. What is the cause-and-effect relationship between exposing milk to strong fluorescent light in supermarket display cases and its flavour profile?
(A) Photo-oxidation of riboflavin and methionine, producing a "sunlight" off-flavor.
(B) Non-enzymatic degradation of milk lactose, resulting in an unnaturally sweet taste.
(C) Rapid enzymatic hydrolysis of casein proteins, producing a sharp, bitter cheese flavor.
(D) Thermal activation of natural lipases, yielding a buttery aroma from diacetyl synthesis.

70. If laboratory tests on brightly coloured sweets detect Rhodamine B, what is the regulatory classification of this substance?
(A) It is a legally permitted synthetic food color under current regulatory limits up to 50 ppm.
(B) It is a safe nature-identical pink dye commonly used in micro-quantities for sugar candies.
(C) It is an organic pigment from rose petals, where a lingering bitter taste is an inherent trait.
(D) It is a strictly prohibited, toxic industrial dye used fraudulently to achieve pink hues.

71. Given below are two statements:
Statement I: Tartrazine (E102) has been associated with allergic-type reactions, particularly in individuals sensitive to aspirin.
Statement II: Because of its allergenicity, Tartrazine has been banned globally across all food categories.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

72. Which of the following synthetic colours is an exception and does NOT produce a red or pink hue?
(A) Carmoisine
(B) Ponceau 4R
(C) Indigo Carmine
(D) Erythrosine

73. What is the most appropriate technological reason for using nature-identical flavouring substances instead of natural flavour extracts in large-scale beverage production?
(A) They supply the exact same micronutrient and antioxidant profiles as the original raw whole fruit.
(B) They are chemically exempt from standard declaration requirements on consumer product labels.
(C) They completely avoid the protein precipitation issues common with natural botanical extracts.
(D) They guarantee batch consistency, cost-efficiency, and a stable supply free from agricultural limits.

NODIA

74. Which of the following is an incorrect pair of a processing technique and its general impact on natural pigments?
(A) Freeze-drying - Completely destroys carotenoids due to sublimation
(B) Retorting (Canning) - Degrades chlorophyll to pheophytin
(C) High-Pressure Processing (HPP) - Generally retains anthocyanin structure better than thermal processing
(D) Blanching - Inactivates polyphenol oxidase, preventing enzymatic browning

75. If a product labelled "100% Natural Organic Fruit Juice" lists "E110" in the ingredients, which regulatory action is correct?
(A) Allow the product, as E110 represents naturally extracted orange juice.
(B) Cite the product for misbranding because E110 is Sunset Yellow, a synthetic artificial colour.
(C) Approve the label, provided the ADI of E110 is not exceeded.
(D) Request the manufacturer to change the name of E110 to "Beta-carotene" to comply with organic standards.

76. Consider the following statements regarding flavour development during the cooking process:
I. Caramelisation involves the thermal degradation of sugars in the absence of amino acids.
II. The Strecker degradation is a crucial step in the Maillard reaction yielding aldehydes that contribute to aroma.
III. Boiling meat in water at 100°C generates more intense Maillard browning than grilling it at 200°C.
IV. High moisture environments generally inhibit the advanced stages of the Maillard reaction.
Which of the given statements are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I and IV

77. What is the specific chemical entity responsible for the bright red colour of fresh meat, which serves as a target for stabilisation in modified atmosphere packaging?
(A) Oxymyoglobin
(B) Metmyoglobin
(C) Deoxymyoglobin
(D) Nitrosylhemochrome

78. Which of the following statements incorrectly describes the properties of curcumin?
(A) It is the principal pigment found in turmeric.
(B) It possesses antioxidant properties.
(C) It exhibits high solubility in cold, acidic water.
(D) It is sensitive to alkaline conditions, turning reddish-brown.

79. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The encapsulation of volatile flavours in a maltodextrin matrix significantly extends the shelf life of dry soup mixes.
Reason (R): The maltodextrin matrix acts as a physical barrier that restricts oxygen penetration and prevents the volatilization of flavour compounds.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

80. How is "Caramelisation" best defined in food chemistry?
(A) A complex browning reaction occurring solely between reducing sugars and free amino acids.
(B) The enzymatic oxidation of reactive phenolic compounds in the presence of atmospheric oxygen.
(C) The non-enzymatic thermal degradation pathway of pure carbohydrates heated at high temperatures.
(D) The chemical conversion of green chlorophyll into olive-brown pheophytin via prolonged heating.

81. A bakery wishes to accelerate the browning on the crust of its pretzels. Which application will most effectively achieve this via the Maillard reaction?
(A) Brushing the dough with a highly acidic solution (pH 2) before baking.
(B) Brushing the dough with an alkaline solution (like lye or baking soda) before baking.
(C) Using purely sucrose (a non-reducing sugar) as the only carbohydrate source.
(D) Baking the pretzels in a steam-injected oven at very low temperatures (80°C).

82. Match the E-number in List I with its corresponding chemical name in List II:
List I: (E-number)
P. E102
Q. E124
R. E133
S. E150d
List II: (Chemical Name)
I. Brilliant Blue FCF
II. Tartrazine
III. Ponceau 4R
IV. Sulfite Ammonia Caramel
(A) P-II, Q-III, R-I, S-IV
(B) P-III, Q-II, R-I, S-IV
(C) P-II, Q-I, R-III, S-IV
(D) P-I, Q-II, R-IV, S-III

83. Which of the following represents a correct pair of a toxicological concern and its associated colouring or flavouring agent?
(A) "Popcorn lung" (Bronchiolitis obliterans) - Diacetyl
(B) 4-Methylimidazole (4-MEI) - Caramel Class

Downloaded from www.pdf.tube

I
(C) Hyperactivity in children - Anthocyanins
(D) Carcinogenic heavy metal contamination - Beta-carotene

84. What is the cause-and-effect relationship of utilizing a high concentration of sulfur dioxide (SO_2) as a preservative in a strawberry jam formulation?
(A) It aggressively accelerates the Maillard reaction, turning the fruit jam deep black.
(B) It bleaches the natural anthocyanin pigments, causing a severe loss of red color.
(C) It permanently enhances the strawberry aroma by synergizing with volatile natural esters.
(D) It rapidly converts any remaining green chlorophyll into a bright metallic blue pigment.

85. In developing a retort-pouched spinach product, which of the following modifications is theoretically possible to retain the green colour?
(A) Adding zinc or copper salts to form stable metallo-porphyrin complexes.
(B) Increasing the sterilization temperature and time drastically.
(C) Fermenting the spinach to lower the pH before retorting.
(D) Adding a high dose of ascorbic acid to induce rapid oxidation.

86. Given below are two statements:
Statement I: The use of MSG (Monosodium Glutamate) is strictly banned in all commercially produced foods.
Statement II: "Chinese Restaurant Syndrome" is a term originally coined to describe symptoms like headache and palpitations controversially linked to MSG consumption.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is false but Statement II is true.
(D) Statement I is true but Statement II is false.

87. Which of the following is an exception and does NOT represent an advantage of natural colouring agents over synthetic ones?
(A) Perception as a "clean label" ingredient by consumers.
(B) Extremely high tinctorial strength requiring very low dosage.
(C) Potential synergistic health benefits like antioxidant activity.
(D) Absence of regulatory links to hyperactivity in children.

88. What is the most appropriate method to prevent the loss of delicate, volatile natural flavours (such as strawberry or peach) during the manufacture of hard boiled candies?
(A) Injecting flavor ingredients into the sugar boil at peak heat (150°C).
(B) Substituting all volatile natural oils with highly concentrated liquid caramel.
(C) Blending the volatile flavors into the syrup during the cooling phase before molding.
(D) Chemically treating natural extracts with mineral acids to elevate their boiling point.

89. Which of the following constitutes an incorrect pair of a flavour enhancing nucleotide and its source?
(A) Inosine monophosphate (IMP) - Primarily derived from meat/fish sources
(B) Guanosine monophosphate (GMP) - Often derived from dried mushrooms/yeast
(C) Yeast extract - Rich natural source of mixed flavour enhancing nucleotides and amino acids
(D) Monosodium glutamate (MSG) - Derived exclusively from synthetic petroleum byproducts

90. If a bakery product labelled "Contains No Added Synthetic Colours" is found upon laboratory analysis to contain E122, what is the correct compliance conclusion?
(A) The product is misbranded and adulterated, as E122 is Carmoisine, a synthetic azo dye.
(B) The bakery is compliant; E122 is a natural beetroot extract.
(C) The bakery is compliant as long as E122 is below 100 ppm, regardless of the label.
(D) The lab analysis must be wrong because synthetic dyes cannot survive the baking process.

NODIA

91. Consider the following statements regarding the stability of specific pigments during processing:
I. Chlorophylls are stable in alkaline conditions but degrade rapidly in acidic environments.
II. Betalains are more stable than anthocyanins in low-acid foods (pH 4 to 7).
III. Carotenoids are highly susceptible to oxidative degradation due to their conjugated

(D) I and IV

137. Under standard food safety regulations, what is the maximum permitted concentration for the majority of approved synthetic food colours in general solid food commodities (unless a specific higher limit is granted)?
(A) 10 ppm (mg/kg)
(B) 500 ppm (mg/kg)
(C) 1000 ppm (mg/kg)
(D) 100 ppm (mg/kg)

138. Which of the following statements incorrectly represents the toxicology and safety of Caramel colours?
(A) Caramel Class IV is universally banned globally because of its severe acute toxicity.
(B) Caramel Class I is generally considered the safest as it is produced without ammonium or sulfite compounds.
(C) Caramel Class III is produced using ammonium compounds and may contain 4-MEI.
(D) Regulatory bodies impose strict limits on the levels of 4-MEI allowable in Caramel Classes III and IV.

139. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The intense pink colour of commercially cured meats (like ham and bacon) remains stable even after rigorous cooking.
Reason (R): The addition of nitrites/nitrates during curing leads to the formation of nitrosylhemochrome during heating, which is a stable pink pigment.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

140. How is "Flavour Profile Analysis" (FPA) formally defined in the realm of sensory science?
(A) An analytical chemistry method using gas chromatography to list all volatile chemical components.
(B) A descriptive sensory method detailing all flavor attributes, intensities, and order of appearance.
(C) An industrial calculation of the exact financial cost contribution of flavoring ingredients in a recipe.
(D) A rapid consumer hedonic evaluation to determine whether a finished product is liked or disliked.

141. To produce a perfectly clear, transparent apple juice that still retains a strong, natural apple aroma, which method is most effective?
(A) Using aroma recovery during evaporation and blending the recovered volatiles back into the clear juice.
(B) Keeping the juice entirely unfiltered to retain the volatile compounds bound to the cloudy pectin matrix.
(C) Applying an intensive high-temperature boil to settle solids, then bottling the clear liquid immediately.
(D) Adding a heavy dosage of dark Caramel Class IV colorant to visually mask any residual cloudiness.

142. Match the specific Flavour Defect in List I with its primary underlying chemical cause in List II:
List I: (Flavour Defect)
P. Warmed-over flavour (WOF) in cooked meats
Q. Sunlight flavour in milk
R. Cardboard or Hay-like flavour in unblanched frozen vegetables
S. Rancidity in frying oils
List II: (Chemical Cause)
I. Photo-oxidation of riboflavin and amino acids
II. Enzymatic oxidation of lipids by lipoxygenase
III. Autoxidation of membrane phospholipids during refrigeration
IV. Hydrolytic or oxidative degradation of triglycerides at high heat
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-II, R-I, S-IV
(D) P-II, Q-I, R-IV, S-III

143. Which of the following represents a correct pair of an artificial flavouring agent and the specific chemical class to which it belongs?
(A) Diacetyl - Amine
(B) Vanillin - Hydrocarbon
(C) Cinnamaldehyde - Ketone
(D) Ethyl butyrate - Ester

Click Here to Buy book on Amazon

98. Which of the following represents a correct pair regarding a flavouring agent and its regulatory classification based on source or synthesis?
(A) Diacetyl - Natural flavouring substance (when synthesized industrially)
(B) Vanillin extracted directly from vanilla pods - Artificial flavouring agent
(C) Linalool extracted from coriander - Nature-identical flavouring substance
(D) Ethyl maltol - Artificial flavouring agent

99. What is the direct cause-and-effect relationship of the Maillard reaction producing acrylamide in specific foods?
(A) Heating foods rich in asparagine and reducing sugars forms acrylamide.
(B) Dairy fermentation by active lactic acid bacteria produces acrylamide.
(C) Enzymatic browning of fruit tissues exposed to oxygen yields acrylamide.
(D) Adding synthetic azo dyes to highly acidic beverages creates acrylamide.

100. If a bright yellow powder used as an adulterant in turmeric powder turns magenta when treated with concentrated hydrochloric acid (HCl), what is the adulterant?
(A) Pure Curcumin extract
(B) Tartrazine
(C) Metanil Yellow
(D) Saffron extract

101. Given below are two statements:
Statement I: Cochineal extract (Carmine) is a highly stable natural red dye derived from the dried bodies of the female Dactylopius coccus insect.
Statement II: Because Carmine is naturally derived, it is universally accepted in vegan and strictly vegetarian food products.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

102. Which of the following food categories is an exception, where the addition of synthetic colours is generally permitted under specific food safety regulations?
(A) Raw meat and poultry
(B) Pasteurized milk
(C) Fresh fruits and vegetables
(D) Carbonated fruit beverages

103. What is the most appropriate technological justification for utilizing "Spray Chilling" (or Spray Cooling) over "Spray Drying" for flavour encapsulation?
(A) It achieves the complete removal of moisture from volatile compounds without requiring any thermal energy.
(B) It protects volatile flavors from high thermal damage by using solid lipid-based carrier matrices instead.
(C) It relies on instant sublimation under vacuum to provide a highly porous finished powder structure.
(D) It actively promotes rapid non-enzymatic Maillard browning during the low-temperature physical encapsulation.

104. Which of the following constitutes an incorrect pair of a natural colour source and its primary pigment?
(A) Saffron - Crocin (Carotenoid)
(B) Annatto - Bixin and Norbixin
(C) Spirulina - Betanin
(D) Paprika - Capsanthin

105. For a child weighing 20 kg, if the ADI of Tartrazine is 7.5 mg/kg body weight, what is the maximum absolute amount of Tartrazine this child can safely consume per day?
(A) 7.5 mg
(B) 75 mg
(C) 1500 mg
(D) 150 mg

106. Consider the following statements regarding the stability of Anthocyanins:
I. Anthocyanins exhibit optimal colour stability and intensity at an acidic pH (pH 1 to 3).
II. The presence of ascorbic acid (Vitamin C) always protects anthocyanins from degradation.
III. Anthocyanins can form stable, deeply coloured complexes (copigmentation) with other flavonoids or metal ions.
IV. High-temperature processing generally causes cleavage of the anthocyanin structure, leading to colourless or brown end products.
Which of the given statements are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

NODIA

double bond system.
IV. Anthocyanins are exceptionally stable to heat and can undergo prolonged boiling without colour loss.
Which of the given statements are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I and II

92. Which specific analytical technique is globally recognised as the gold standard for separating, identifying, and quantifying complex volatile aroma compounds in food products?
(A) Atomic Absorption Spectroscopy (AAS)
(B) Gas Chromatography-Mass Spectrometry (GC-MS)
(C) Fourier Transform Infrared Spectroscopy (FTIR)
(D) High-Performance Liquid Chromatography (HPLC)

93. Which of the following statements incorrectly outlines regulations on food colours?
(A) Synthetic colours are freely permitted in infant formulas to make them visually appealing to babies.
(B) The maximum permitted limit for synthetic colours is typically 100 mg/kg in the final food for consumption.
(C) Food products containing permitted synthetic food colours must carry a specific declaration on the label.
(D) The use of inorganic colouring matters and pigments is generally prohibited unless specifically permitted.

94. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Lycopene in tomatoes becomes significantly more bioavailable when the tomatoes are cooked in the presence of dietary fat.
Reason (R): Thermal processing breaks down the plant cell matrix, and the lipophilic nature of lycopene allows it to dissolve in the added fat, facilitating intestinal absorption.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

95. How is "Taste Synergism" defined in the context of flavour enhancers?
(A) The complete sensory suppression of bitter notes after adding a highly concentrated organic acid.
(B) The laboratory synthesis of complex artificial food flavors using two separate natural precursors.
(C) The physical stabilization of two highly immiscible liquid flavor fractions using a food emulsifier.
(D) The effect where two flavor enhancers together produce an intensity far exceeding their individual sum.

96. A snack food company is formulating a cheese-flavoured corn puff and wants to maximize the umami intensity without exceeding legal sodium limits. Which formulation strategy should they adopt?
(A) Utilize exclusively monosodium glutamate (MSG) added up to its maximum concentration limit.
(B) Replace the entire savory flavor matrix with basic refined sodium chloride (table salt).
(C) Combine glutamate with nucleotides to exploit synergistic flavor-enhancing relationships.
(D) Add citric acid to drastically lower the pH, which biologically enhances umami receptor activity.

97. Match the Food Product or Application in List I with its typically associated approved synthetic colour in List II:
List I: (Food Product/Application)
P. Green mint syrup
Q. Orange-flavoured soft drink
R. Red cherry preserves
S. Lemon-flavoured candy
List II: (Synthetic Colour)
I. Tartrazine
II. Sunset Yellow
III. Erythrosine
IV. Fast Green FCF
(A) P-IV, Q-II, R-III, S-I
(B) P-IV, Q-III, R-II, S-I
(C) P-I, Q-II, R-III, S-IV
(D) P-II, Q-I, R-IV, S-III

Downloaded from www.pdf.tube

hard, dark clumps.

115. A food processor extracts essential oils from cloves using steam distillation. However, the resulting extract lacks the full, rounded flavour profile of the raw clove. What is the most scientifically sound explanation?
(A) It extracts only volatile, lipophilic compounds while leaving non-volatile and water-soluble notes behind.
(B) High-temperature steam processing completely destroys all sensitive and volatile aromatic compounds.
(C) The thermal extraction process chemically converts natural eugenol directly into synthetic vanillin.
(D) True essential oil compounds cannot be physically separated from dry spices utilizing direct heat.

116. Given below are two statements:
Statement I: Sunset Yellow (E110) is a commonly used synthetic azo dye that imparts an orange-yellow hue to foods.
Statement II: Azo dyes are characterised by the presence of a double bond between two nitrogen atoms (-N=N-) in their chemical structure.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

117. Which of the following is an exception and is NOT considered a mechanism by which flavours are lost during the high-temperature extrusion cooking of cereals?
(A) Sublimation of flavors within the high-pressure extruder barrel.
(B) Flash volatilization at the die exit due to sudden pressure drops.
(C) Chemical binding with starch and proteins to form inclusion complexes.
(D) Direct thermal degradation or oxidation of sensitive aroma molecules.

118. What is the most universally applicable strategy to minimise the formation of acrylamide when frying potato crisps?
(A) Frying the crisps at exceedingly high temperatures to shorten the total required thermal exposure.
(B) Selecting potato varieties with very high reducing sugar and asparagine content.
(C) Applying a heavy concentration of synthetic yellow colorant to visually cover up dark browning.
(D) Blanching the potato slices in hot water prior to frying to leach out reactive sugars and asparagine.

119. Which of the following constitutes an incorrect pair of a flavour terminology and its sensory meaning?
(A) Pungency - A sharp, biting, or penetrating sensory effect (e.g., chilli, mustard)
(B) Umami - A sweet, intensely sugary taste perception
(C) Astringency - A dry, puckering mouthfeel (e.g., strong tea, unripe persimmon)
(D) Cooling - A fresh sensation triggered by specific compounds like menthol

120. If gas chromatography analysis of a fruit juice claiming "Zero Artificial Flavours" reveals high levels of Ethyl Vanillin, what is the correct compliance conclusion?
(A) The claim is valid because Ethyl Vanillin is extracted naturally from vanilla beans.
(B) The claim is valid because Ethyl Vanillin is a nature-identical flavouring, which is legally considered "non-artificial."
(C) The claim is false because Ethyl Vanillin is a well-known artificial flavouring agent, not found in nature.
(D) The claim is irrelevant as vanilla flavours are exempt from standard food regulations.

NODIA

121. Consider the following statements regarding the regulatory framework for colours and flavours:
I. Codex Alimentarius provides international guidelines, but sovereign nations enforce their own national standards.
II. Food safety regulations explicitly permit the use of Sunset Yellow in infant milk substitutes.
III. Flavour enhancers like MSG must not be added to pastas and noodles designated specifically for infants.
IV. National and international food authorities rely on JECFA (Joint FAO/WHO Expert Committee on Food Additives) for toxicological risk assessments.
Which of the given statements are correct?
(A) I, II, and IV
(B) I, III, and IV
(C) II, III, and IV

107. Which specific class of chemical compounds is predominantly responsible for the "fruity" aromas typically synthesized naturally during the ripening of fruits like apples and bananas?
(A) Amines
(B) Esters
(C) Carboxylic acids
(D) Pyrazines

108. Which of the following statements incorrectly describes the properties of synthetic food colours compared to natural colours?
(A) Synthetic colours have higher tinctorial strength.
(B) Synthetic colours often carry a complex, appealing inherent flavour.
(C) Synthetic colours exhibit superior stability to light, heat, and pH variations.
(D) Synthetic colours are generally less expensive to produce at scale.

109. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The food industry is experiencing a massive shift towards "clean-label" colours extracted from fruits, vegetables, and edible plants.
Reason (R): Regulatory agencies globally have mandated the complete banning of all synthetic colours by the year 2025.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

110. How does the food industry define "Essential Oils" used as flavouring agents?
(A) Synthetic flavor chemicals dissolved in a carrier matrix of petroleum-derived lipids.
(B) The non-volatile water-soluble fraction recovered after boiling aromatic herbs.
(C) Volatile plant liquids containing aromatic compounds obtained by distillation.
(D) Refined seed oils intentionally oxidized to yield highly specific rancid odors.

111. In a Thin Layer Chromatography (TLC) run to identify dyes in a candy, the solvent front moves 10 cm. If the red dye moves 6 cm and the yellow dye moves 8 cm, what are the Retardation Factor (R_f) values for the red and yellow dyes, respectively?
(A) 6.0 and 8.0
(B) 0.4 and 0.2
(C) 1.6 and 1.25
(D) 0.6 and 0.8

112. Match the Colouring Agent in List I with its primary stability challenge during food processing in List II:
List I: (Colouring Agent)
P. Anthocyanins
Q. Chlorophyll
R. Curcumin
S. Beta-carotene
List II: (Primary Stability Challenge)
I. Loss of central magnesium ion in acidic or heat conditions
II. Oxidation due to conjugated double bonds upon light or oxygen exposure
III. Rapid degradation and loss of red colour in alkaline environments
IV. Highly sensitive to light, rapid fading in transparent packaging
(A) P-III, Q-I, R-IV, S-II
(B) P-I, Q-III, R-II, S-IV
(C) P-III, Q-IV, R-I, S-II
(D) P-II, Q-I, R-IV, S-III

113. Which of the following represents a correct pair of a processed food flavour note and the primary chemical pathway responsible for it?
(A) Fresh cut grass smell in crushed leaves - Maillard reaction
(B) Smoky, burnt notes in dark caramel - Severe Caramelisation
(C) Onion-like pungent flavour - Lipid oxidation
(D) Sweet, floral notes in honey - Proteolysis

114. What is the cause-and-effect outcome of storing dehydrated onion powder in an environment with high relative humidity and warm temperatures?
(A) The dehydrated onion powder will rapidly undergo localized enzymatic browning reactions only.
(B) The dry product will lose all its natural pigments, eventually turning completely bright white.
(C) The carbohydrate content will undergo spontaneous, rapid chemical caramelization of starches.
(D) The powder will absorb moisture, accelerating Maillard browning to yield

Click Here to Buy book on Amazon

inhalation can cause severe obstructive lung disease.
(C) It causes the popcorn matrix to rapidly absorb environmental humidity and become totally stale.
(D) It operates as a highly potent chemical preservative, extending the finished shelf life indefinitely.

130. If a food product contains condensed liquid smoke components to impart a "smoky" flavour, what is its regulatory requirement?
(A) The formulation is legally compliant without any declaration because liquid smoke is chemically identical to natural wood aging.
(B) All wood smoke flavorings are banned, requiring immediate condemnation and disposal.
(C) The manufacturer is only required to change the product name to "Barbecue Seasoning".
(D) The product must explicitly declare "Smoke Flavoring" in the ingredients list.

131. Given below are two statements:
Statement I: The Maillard reaction rate generally increases as water activity (a_w) decreases, reaching a maximum around a_w 0.6 - 0.7, before dropping at very low moisture levels.
Statement II: Lipid oxidation reactions strictly follow the exact same water activity curve, peaking at a_w 0.6.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

132. Which of the following food processing methods is an exception and is typically considered a "non-thermal" technology that excellently preserves delicate natural flavours and pigments?
(A) Ohmic heating
(B) UHT Pasteurization
(C) High-Pressure Processing (HPP)
(D) Extrusion cooking

133. What is the most widely adopted method in the food industry for identifying and quantifying the exact levels of multiple synthetic food colours in a complex food matrix?
(A) High-Performance Liquid Chromatography (HPLC) equipped with a Diode Array Detector (DAD).
(B) High-resolution Gas Chromatography (GC) coupled directly to a Flame Ionization Detector (FID).
(C) Standard paper chromatography methods followed by subjective manual visual inspection of spots.
(D) Direct chemical neutralization titration using a standardized aqueous sodium hydroxide base.

134. Which of the following constitutes an incorrect pair regarding the degradation of a pigment and its resulting visual colour?
(A) Chlorophyll → Pheophytin (Olive-brown)
(B) Anthocyanin at high pH → Chalcone (Colourless/Yellow)
(C) Oxymyoglobin → Metmyoglobin (Brown)
(D) Beta-carotene → Thermal isomerisation (Bright Blue)

135. Which of the following facts explains how a water-soluble form of Annatto can be obtained for food formulation?
(A) Annatto contains only lipophilic bixin, making any water-soluble application physically impossible.
(B) Annatto contains bixin which can be chemically saponified into water-soluble norbixin.
(C) Annatto seeds naturally contain high percentages of anthocyanin molecules which dissolve in water.
(D) Annatto is exclusively a synthetic azo dye and cannot be obtained in a natural water-soluble form.

136. Consider the following statements regarding the stability of specific flavours during food storage:
I. Essential oils are prone to oxidative degradation (rancidity) when exposed to oxygen and light.
II. Limonene, the major flavour component of citrus oils, can oxidize to form carvone or carveol, leading to off-flavours.
III. Flavour encapsulation in maltodextrin totally eliminates the need for any other packaging barrier.
IV. High-temperature storage accelerates the loss of volatile flavours through permeation of packaging materials.
Which of the given statements are correct?
(A) I, II, and IV
(B) II, III, and IV
(C) I, II, and III

Downloaded from www.pdf.tube

(D) I, II, and III

122. Which specific enzyme, if not inactivated by blanching, is primarily responsible for the development of off-flavours (such as "hay-like" or "cardboard") in frozen green beans during storage?
(A) Lipoxygenase
(B) Polyphenol oxidase
(C) Pectin methylesterase
(D) Amylase

123. Which of the following statements incorrectly characterizes the flavour compound Vanillin?
(A) It is the primary aroma compound in vanilla beans.
(B) Synthetic vanillin is structurally completely different from natural vanillin.
(C) It can be naturally extracted or synthesized industrially (e.g., from lignin).
(D) It is widely used in baking and confectionery due to its sweet, creamy aroma.

124. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The colour of raw meat turns from bright red to brown when exposed to air for an extended period.
Reason (R): The bright red oxymyoglobin undergoes oxidation of its iron atom from the ferrous (Fe^{2+}) to the ferric (Fe^{3+}) state, forming brown metmyoglobin.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

125. How is "Encapsulation Efficiency" broadly defined in the context of flavour microencapsulation?
(A) The percentage of core flavor compound successfully trapped inside the finished microcapsules.
(B) The operating speed and throughput of the atomizer inside a large commercial spray drying unit.
(C) The absolute mass of moisture removed from the feed emulsion during the continuous drying process.
(D) The relative intensity of the volatile flavor notes as perceived by a trained sensory panel.

126. A beverage formulator is creating a bright green, clear, acidic sports drink (pH 3.0). To achieve the green colour using only natural clean-label options, which option is most appropriate?
(A) Blending natural anthocyanins and betalains to produce a balanced green pigment blend.
(B) Using pure copper chlorophyllin, ensuring the pH of the system is dropped down to 2.0.
(C) Blending cold-processed spirulina and safflower extracts under non-thermal conditions.
(D) Using Caramel Class I mixed with beetroot juice extract to achieve a deep green hue.

127. Match the Food Processing Operation in List I with its primary intended effect on colour/ flavour in List II:
List I: (Food Processing Operation)
P. Blanching
Q. Roasting
R. Sulfiting
S. Fermentation
List II: (Primary Intended Effect)
I. Generates complex Maillard and caramelisation flavour profiles
II. Inactivates enzymes to preserve natural colour and prevent off-flavours
III. Prevents enzymatic browning but may bleach natural red pigments
IV. Produces lactic acid, imparting a characteristic sour or tangy flavour
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-I, R-II, S-IV

128. Which of the following represents a correct pair of a natural colorant and the typical extraction solvent used to obtain it?
(A) Anthocyanin - Pure non-polar lipid solvents
(B) Caramel - Distilled water at freezing temperature
(C) Beta-carotene - Hexane or edible oils
(D) Curcumin - Highly acidic aqueous solutions

129. What is the cause-and-effect relationship regarding the excessive addition of Diacetyl to microwave popcorn formulations?
(A) It drastically increases physical expansion, yielding a far larger volume of popped corn.
(B) It imparts a rich buttery flavor, but chronic

NODIA

144. What is the justification for strictly prohibiting the use of artificial colours in fresh, raw, and unprocessed fruits and vegetables?
(A) Adding artificial dyes aggressively catalyzes the biological fruit respiration and ripening processes.
(B) Natural plant acids metabolize synthetic dyes into highly toxic, lethal chemicals upon physical contact.
(C) Adding artificial color can easily mask structural defects and age, thus misleading the consumer.
(D) Surface-applied synthetic dyes block the peel pores, preventing the fruit from absorbing air humidity.

145. If a batch of vividly yellow-coloured lemon candies triggers severe allergic reactions (such as urticaria and asthma), which specific synthetic dye is the most likely cause?
(A) Brilliant Blue
(B) Tartrazine (E102)
(C) Fast Green FCF
(D) Titanium Dioxide

146. Given below are two statements:
Statement I: Certain flavour compounds can chemically bind to food matrix proteins, particularly via hydrophobic interactions or covalent bonds with amino acid side chains, leading to a phenomenon known as "flavour scalping" or fading.
Statement II: Carbohydrates like starch can physically entrap volatile flavour compounds within their helical structures (inclusion complexes), thereby altering flavour perception.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

147. Which of the following elements is an exception and is strictly NOT an essential requirement for the Maillard browning reaction to initiate?
(A) Polyphenol oxidase
(B) A reducing sugar
(C) An amino group (typically from an amino acid or protein)
(D) Water

148. What is the most universally effective method to stabilise natural anthocyanin extracts against rapid degradation when formulated into a clear, ambient-stable sports drink?
(A) Maintaining a highly alkaline pH of 8.0 or above to prevent chemical structural transitions.
(B) Constantly saturating the beverage with high concentrations of oxygen during hot filling.
(C) Utilizing copigmentation with natural flavonoids alongside keeping pH low and shielding UV light.
(D) Dosing the formulation with massive quantities of divalent iron and copper salts to bind color.

149. Which of the following constitutes an incorrect pair regarding a regulatory standard/body and its defining characteristic in relation to food additives?
(A) GMP rules - Dictates precise numerical limits in ppm for all natural color usage.
(B) Food safety regulations - Mandates specific warning declarations for synthetic colors on product labels.
(C) Codex standards - Provides globally unified, science-based guidelines for food additive safety.
(D) JECFA panels - Conducts independent toxicological assessments to establish acceptable daily intakes.

150. If a formulation for a child's beverage lists the following ingredients: "Water, Sucrose, Natural Apple Extract, E102, E133, Ascorbic Acid, MSG (0.5%)", what is the safety assessment?
(A) The formulation is perfectly compliant for sale as a commercial fruit beverage.
(B) The formulation violates food laws because mixing E102 with E133 forms toxic compounds.
(C) The beverage is legal provided a warning label highlighting sleepiness risks is added.
(D) The beverage is non-compliant because MSG addition is prohibited in foods for young children.

www.nodia.in

Click Here to Buy book on Amazon

54. (D) It preserves the bright green color by preventing the loss of central magnesium from chlorophyll.
Adding an alkaline substance like baking soda to cooking water neutralizes the organic acids released from plant tissues during boiling. This neutral-to-alkaline environment prevents hydrogen ions from attacking the chlorophyll molecule, thereby inhibiting the displacement of the central magnesium ion. This chemical preservation keeps the chlorophyll intact, maintaining the bright green color of boiled vegetables.

55. (B) The water used for the formulation had a highly alkaline pH.
Anthocyanins are highly sensitive indicators of pH, changing structure and color based on the acidity of their medium. Under acidic conditions, they form the red flavylium cation. When the pH shifts to alkaline values, the structure transforms into the blue-purple quinonoidal base. Therefore, using highly alkaline water during formulation triggers this shift, turning the red pigment blue.

56. (C) Statement I is true but Statement II is false.
Essential oils provide concentrated, desirable flavor profiles in foods but present significant stability challenges due to their volatility and susceptibility to oxidation. However, the carrier materials used for spray-drying encapsulation must be highly water-soluble, such as maltodextrin or gum arabic, to facilitate rapid release in the human digestive system, making the second statement false.

57. (D) Brilliant Blue FCF
Brilliant Blue FCF is a synthetic food colorant belonging to the triarylmethane chemical class, characterized by its triphenylmethane backbone. Conversely, Tartrazine, Sunset Yellow, and Carmoisine are synthetic azo dyes characterized by the presence of one or more azo nitrogen-nitrogen double bonds. This structural difference influences their chemical properties, stability profiles, and regulatory classifications.

58. (A) High-Performance Liquid Chromatography (HPLC) coupled with a Diode Array Detector (DAD).
High-Performance Liquid Chromatography coupled with a Diode Array Detector is the most comprehensive and legally robust methodology for separating, identifying, and quantifying multiple synthetic dyes within a complex food matrix. It allows for the simultaneous absorption wavelength profiling of analytes, ensuring high sensitivity and selectivity required to detect trace quantities of non-permitted chemical colorants.

NODIA

59. (B) Synthetic food colour in canned peas - 1000 ppm
A concentration of 1000 ppm for synthetic food colors in canned peas is excessively high and violates food safety regulations, which typically limit synthetic dye usage to 100 ppm. Natural colors are governed by Good Manufacturing Practices limits, and flavored milks are permitted up to 100 ppm. Proper limits prevent excessive exposure to synthetic chemicals.

60. (B) Incorporate a beetroot juice concentrate (betalains) while avoiding high thermal processing.
Beetroot juice concentrate contains betalains, which provide a rich red color suitable for coloring strawberry yogurt. Since synthetic dyes are prohibited and carmine is not vegetarian, betalains are the optimal clean-label solution. Because betalains are heat-sensitive, avoiding high-temperature processing steps after addition prevents color degradation, ensuring a vibrant red product that aligns with vegetarian demands.

61. (A) I and III
Food regulations require specific label declarations for products containing permitted synthetic colors. Additionally, adding MSG to savory foods requires a clear advisory statement warning that the product is not recommended for infants under twelve months. However, solvent-extracted natural flavors do not require the prefix artificial, making statements I and III the only correct regulatory assertions.

62. (C) Allicin
Allicin is an organosulfur compound that is the primary driver of the characteristic pungent, sulfurous aroma of freshly crushed garlic. It is synthesized rapidly when the enzyme alliinase cleaves the substrate alliin upon cellular tissue damage. Allicin is unstable and decomposes into various diallyl sulfides, which contribute to the complex flavor profile of cooked garlic.

63. (D) They contain novel chemical bonds that the human digestive system cannot metabolize.
Nature-identical flavoring substances are chemically synthesized but are molecularly identical to compounds found in nature. Because

9. (D) Acidic displacement of the central magnesium ion in chlorophyll by hydrogen ions to form pheophytin.
During the thermal processing of green vegetables, plant cellular membranes rupture, releasing organic acids into the medium. These hydrogen ions displace the central magnesium ion situated within the porphyrin ring of the chlorophyll molecule. This chemical reaction converts bright green chlorophyll into pheophytin, which is chemically responsible for the characteristic, undesirable olive-brown coloration of processed vegetables.

10. (B) II, IV, III, I
The degradation of intact chlorophyll begins with the displacement of the central magnesium ion by hydrogen ions, forming pheophytin. Subsequently, the phytol ester chain is cleaved through enzymatic action or continued heating, resulting in the formation of pheophorbide. This precise sequential pathway describes how green pigments progressively lose their metallic center and hydrophobic tail during thermal processing.

11. (C) Statement I is true but Statement II is false.
Anthocyanins are highly sensitive to pH variations, appearing red under acidic conditions and shifting to blue or green in alkaline environments. However, their stability is significantly affected by environmental factors. The presence of oxygen, ascorbic acid, and certain metal ions accelerates their degradation, meaning their stability is not unaffected, which makes the second statement false under standard chemical conditions.

12. (B) Curcumin
Curcumin is a highly lipophilic polyphenolic compound extracted from turmeric. It is virtually insoluble in water under acidic and neutral conditions but dissolves readily in organic solvents and lipids. Conversely, betanin, cyanidin-3-glucoside, and delphinidin are water-soluble pigments belonging to the betalain and anthocyanin families, respectively, which dissolve easily in aqueous environments during food formulation.

13. (A) Chronic intake above ADI is linked to potential carcinogenicity, hyperactivity in children, and severe allergic reactions.
Monitoring the Acceptable Daily Intake of synthetic food colors is critical because chronic consumption exceeding these established toxicological thresholds is linked to adverse health effects. These include potential carcinogenicity, hyperactivity in sensitive children, and severe allergic reactions like urticaria. Regulating these levels ensures that consumer exposure remains well below the threshold that causes any observable physical harm.

14. (C) Carmoisine - Blue
Carmoisine is a synthetic azo dye that imparts a red to maroon shade in food applications, not blue. Tartrazine provides a bright lemon yellow color, Sunset Yellow produces an orange-yellow hue, and Erythrosine is used to achieve a cherry red coloration. Accurate matching of synthetic dyes with their standard color shades is essential for proper labeling and regulatory compliance.

15. (D) Collect representative samples for confirmatory laboratory analysis using High-Performance Liquid Chromatography (HPLC).
Subjective visual inspection and on-site pH manipulations are insufficient for legal food safety enforcement. High-Performance Liquid Chromatography represents the standard, highly precise analytical methodology required to separate, identify, and quantify specific synthetic and natural pigments within a food matrix. Collecting official samples for laboratory analysis ensures legally defensible evidence regarding the use of non-permitted coloring agents.

16. (C) I and IV
Betalains are nitrogenous water-soluble pigments from beetroot that are relatively stable within a pH range of 3 to 7, showing no dramatic color shifts. Curcumin is highly sensitive to light and alkaline conditions, turning reddish-brown, but offers strong antioxidant and anti-inflammatory properties. Thus, only the statements regarding betalain composition and curcumin health benefits are scientifically accurate.

17. (B) Tartrazine
Tartrazine is a synthetic coal-tar azo dye that was prominently included in the pivotal Southampton study. This research linked a mixture of specific artificial colors and the preservative sodium benzoate to increased hyperactivity and attention deficit behaviors in children. Consequently, regulatory agencies in several jurisdictions require warning labels on food products containing these specific synthetic food dyes.

Downloaded from www.pdf.tube

18. (D) The ADI for Sunset Yellow is uniform globally and remains independent of toxicological re-evaluations.
Acceptable Daily Intake values are not static or globally uniform, as different regulatory jurisdictions update their safety limits based on emerging toxicological data. ADI represents the daily amount of an additive consumable over a lifetime without risk, expressed in milligrams per kilogram of body weight. Occasional daily excursions above the ADI do not necessarily trigger acute toxicological responses.

19. (A) Both A and R are true and R is the correct explanation of A.
Synthetic food colorants are strictly prohibited in fresh, raw, and unprocessed foods like fresh fruits, vegetables, raw meats, and infant foods. These categories constitute critical dietary sources, and adding artificial pigments could deceive consumers by masking spoilage, indicating false ripeness, or simulating higher quality. The restriction protects consumer safety and maintains transparency regarding food freshness.

20. (C) Caramel produced by heating carbohydrates in the presence of both sulfite and ammonium compounds.
Class IV caramel is manufactured through the controlled thermal treatment of food-grade carbohydrates in the presence of both sulfite and ammonium compounds. This specific manufacturing process imparts a strong negative ionic charge to the caramel molecules, rendering this class highly stable in acidic and carbonated beverage systems without causing precipitation or undesirable physical sediment formation.

21. (A) Caramel Class IV
Acidic carbonated beverages like colas possess low pH values around 2.5 and contain phosphoric acid. Caramel Class IV, also known as sulfite ammonia caramel, carries a strong negative colloidal charge. This prevents ionic interactions with proteins and acids in the beverage, avoiding precipitation and cloudiness, and provides excellent light and heat stability under typical ambient storage conditions.

22. (A) P-IV, Q-III, R-II, S-I
Each synthetic food color is assigned a unique international E-number for regulatory tracking. Tartrazine corresponds to E102, Sunset Yellow FCF is designated as E110, Carmoisine is labeled as E122, and Brilliant Blue FCF is identified as E133. Correctly identifying these codes is crucial for interpreting food ingredient declarations and ensuring compliance with international safety standards.

23. (B) Ethyl maltol - Sweet, cotton candy-like
Ethyl maltol is a synthetic organic compound that imparts a highly characteristic sweet, caramelized, cotton candy-like aroma. It is widely used as a flavor enhancer in confectionery and baked goods. Conversely, diacetyl provides a buttery aroma, vanillin provides a sweet vanilla scent, and isoamyl acetate is responsible for the distinct fruity aroma associated with ripe bananas.

24. (C) Formation of 4-methylimidazole (4-MEI) during the ammoniation process.
The primary toxicological concern regarding Caramel Class III and Class IV is the formation of 4-methylimidazole as a chemical byproduct during the high-temperature ammoniation process. Animal studies have linked 4-methylimidazole to potential carcinogenic effects, prompting international regulatory agencies to establish strict maximum allowable limits for this contaminant in commercial caramel coloring agents.

25. (D) Monosodium glutamate
Monosodium glutamate is a sodium salt of the naturally occurring amino acid glutamic acid, widely used to enhance umami flavors. Its consumption in large quantities has been controversially associated with a cluster of transient physical symptoms, including headaches, sweating, facial pressure, and numbness, historically referred to as Chinese Restaurant Syndrome, although scientific reviews indicate no consistent causal link.

26. (C) Statement I is true but Statement II is false.
Natural flavoring substances are obtained exclusively from physical, microbiological, or enzymatic processes acting on plant or animal raw materials. However, artificial flavoring substances possess chemical structures that are entirely novel and not found in nature. Nature-identical flavorings are synthesized chemically but have structures identical to natural compounds, making the second statement false under standard definitions.

27. (B) Ethyl butyrate
Ethyl butyrate is a volatile ester that possesses a strong, fruity aroma resembling pineapple,

NODIA

categorizing it strictly as a flavoring agent rather than a flavor enhancer. Conversely, monosodium glutamate, disodium inosinate, and disodium guanylate do not possess strong standalone aromas but function specifically as flavor enhancers by stimulating umami taste receptors on the human tongue.

28. (B) They act synergistically with Monosodium Glutamate to intensely amplify the umami taste.` Disodium inosinate and disodium guanylate are purine nucleotides that exhibit a powerful synergistic effect when combined with monosodium glutamate. This molecular interaction dramatically enhances the perception of the savory umami taste in food formulations. This synergy allows manufacturers to significantly reduce the overall concentration of monosodium glutamate and sodium chloride required to achieve the desired sensory profile.

29. (A) Strecker degradation - Requires lipid oxidation and high moisture content.
The Strecker degradation is a key step in the Maillard reaction that involves the chemical reaction between an amino acid and a dicarbonyl intermediate compound generated during sugar degradation, not lipid oxidation. This pathway produces volatile aldehydes and aminoketones, which are highly critical for flavor and aroma development in cooked, roasted, and baked food items.

30. (C) Replace 50% of NaCl with Monosodium Glutamate and Disodium Inosinate.
Substituting a portion of sodium chloride with monosodium glutamate and disodium inosinate exploits the powerful taste synergy between glutamate and purine nucleotides. This combination intensely amplifies the savory umami receptors, which increases the perceived saltiness and flavor depth of the food product. This strategy allows for a major reduction in overall sodium content without sacrificing consumer acceptability.

31. (A) I, II, and IV
The Maillard reaction and caramelization are both non-enzymatic browning pathways. The Maillard reaction involves reducing sugars and amino acids, initiating at lower temperatures than caramelization, and yielding complex brown nitrogenous polymers called melanoidins. Caramelization involves only the thermal degradation of pure sugars without amino acids, making the third statement incorrect as amino acids are not involved in caramelization.

32. (C) Buttery
Diacetyl is a volatile vicinal dicarbonyl compound produced naturally during fermentation by lactic acid bacteria or synthesized chemically. It is characterized by an intense, sweet, creamy, buttery aroma profile. It is extensively used in the food industry to flavor products such as microwave popcorn, margarines, spreads, and various baked goods requiring a distinct butter-like sensory note.

33. (B) Encapsulation guarantees permanent flavor retention, completely preventing volatile loss over a decade.
Flavor encapsulation provides significant protection against oxidation and thermal degradation while utilizing techniques like spray drying with carrier materials like maltodextrin. However, it cannot guarantee permanent, absolute flavor retention or completely prevent volatile loss over a decade. Over extended storage periods, volatile molecules slowly diffuse through the carrier matrix, leading to a gradual reduction in flavor intensity.

34. (D) Both A and R are false.
The Maillard reaction is highly unfavorable in extremely acidic environments because acidic conditions protonate the free amino groups of amino acids and proteins. Once protonated, the amino group loses its nucleophilic character, preventing it from attacking the electrophilic carbonyl carbon of reducing sugars. Therefore, both the assertion and the reason are chemically incorrect under standard reaction conditions.

35. (A) Natural source pigments requiring minimal processing and utilizing consumer-friendly ingredients.
Clean-label colors are defined as coloring agents derived exclusively from natural, recognizable sources, such as fruits, vegetables, and edible plants, using physical extraction methods without chemical modifications. These pigments align with clean-label marketing trends by avoiding synthetic chemicals, artificial additives, and complex technical terminology, thereby meeting the growing consumer demand for wholesome, minimally processed food ingredients.

Click Here to Buy book on Amazon

ANSWERS

1. (B) II and III
Carotenoids are hydrophobic, lipid-soluble pigments that produce yellow, orange, and red hues in various foods. Anthocyanins are highly water-soluble pigments whose chemical structures and colors undergo dramatic, reversible alterations in direct response to changes in pH. Conversely, natural colors are generally less stable than synthetic dyes, and betalains remain stable across a broad pH range.

2. (D) Lycopene
Lycopene is an acyclic open-chain carotenoid pigment containing numerous conjugated double bonds. This specific chemical structure is responsible for absorbing light in the visible spectrum, yielding the characteristic deep red coloration observed in ripe tomatoes and watermelons. It is a highly lipophilic compound that is completely insoluble in water but highly soluble in organic solvents and lipids.

3. (A) Colour serves as an absolute indicator of the nutritional density of all processed foods.
Color does not serve as an absolute indicator of nutritional density, particularly in processed foods, because artificial colorants can easily be added to low-nutrient products to enhance their visual appeal. While color creates psychological expectations regarding quality and indicates ripeness or spoilage in fresh foods, processing often alters natural pigments without directly reflecting the overall nutritional profile.

4. (D) A is false but R is true.
Beta-carotene is a highly lipophilic tetraterpene hydrocarbon that is completely insoluble in water and highly soluble in fats, oils, and organic solvents. Because of its lipophilic nature and highly unsaturated structure, it exhibits low stability in aqueous solutions without emulsifiers and rapidly degrades via oxidation in lipid environments when exposed to heat, light, and oxygen.

5. (A) Artificially synthesized compounds that are chemically identical to flavorings found naturally in plants or animals.
Nature-identical flavoring substances are obtained through chemical synthesis or isolation via chemical processes. These synthetic compounds possess molecular structures that are entirely identical to the flavoring components naturally present in vegetable or animal products. They offer a highly cost-effective and consistent alternative to natural extracts while behaving identically during food formulation and processing operations.

NODIA

6. (D) Lutein
Lutein is a xanthophyll carotenoid pigment that is highly lipophilic, making it ideal for integration into lipid-based beverage formulations. In human physiology, lutein selectively accumulates in the macular region of the retina. It acts as an antioxidant and filters blue light, providing documented protection against age-related macular degeneration and supporting overall visual health in humans.

7. (A) P-IV, Q-II, R-I, S-III
Beta-carotene is a tetraterpene hydrocarbon pigment. Chlorophyll is characterized by its magnesium-porphyrin ring complex. Anthocyanins are water-soluble flavonoids that display highly pH-dependent coloration, whereas betalains are nitrogen-containing water-soluble pigments. Matching these biochemical properties correctly connects each natural pigment to its primary chemical group, which is crucial for predicting stability and behavior during food processing operations.

8. (C) Pheophytin - Forms when the central magnesium ion is replaced by two hydrogen atoms.
Pheophytin is generated during food processing when the central magnesium ion within the chlorophyll porphyrin ring is displaced by two hydrogen ions under acidic or high-heat conditions. Chlorophyll a and b differ by having a methyl or formyl group at position 7, not 3. Pheophorbide is produced specifically when chlorophyllide undergoes demetallation, losing its magnesium ion.

45. (A) Issue a non-compliance report as MSG is strictly prohibited in foods intended for infants below 12 months.
Food safety regulations strictly prohibit the addition of monosodium glutamate to foods formulated specifically for infants below twelve months of age. This precautionary regulation protects developing metabolic and nervous systems from high concentrations of free glutamate. Therefore, detecting MSG in infant foods constitutes a serious regulatory non-compliance that requires immediate corrective enforcement and product recall.

46. (A) I, II, and IV
Tartrazine possesses high thermal and light stability, making it ideal for baked goods. Betacyanins are heat-sensitive and degrade during thermal processing, while lycopene undergoes beneficial trans-to-cis isomerisation upon heating, improving bioavailability. Conversely, chlorophyll is highly unstable in acidic environments, rapidly turning into olive-brown pheophytin, which makes the third statement scientifically incorrect.

47. (D) Red cabbage anthocyanins
Red cabbage anthocyanins serve as an excellent natural alternative to the synthetic red azo dye Carmoisine in acidic food systems. These water-soluble pigments provide a vibrant, stable red color in low-pH environments typical of many dairy products and confectionery. Their utilization supports clean-label formulations while avoiding synthetic chemical additives and ensuring compliance with vegetarian dietary standards.

48. (C) The reaction rate decreases exponentially as the water activity reaches the range of 0.6 to 0.8.
The Maillard reaction rate does not decrease exponentially within the intermediate water activity range; rather, it reaches its maximum speed between 0.6 and 0.8 water activity. At this level, reactants are sufficiently concentrated yet mobile. High temperatures and alkaline conditions strongly favor the reaction, while the condensation reaction results in the nutritional loss of essential lysine.

49. (C) A is true but R is false.
Saffron and turmeric are highly valued in culinary traditions because they contain natural pigments like crocin and curcumin, which provide vibrant colors and distinctive flavors. However, these pigments are organic molecules synthesized through natural plant biosynthetic pathways, not synthetic azo dyes. Synthetic azo dyes are petroleum-derived compounds created in industrial laboratories, making the reason completely false.

50. (D) The development of off-flavors in refined lipids due to mild oxidation prior to the onset of true rancidity.
Flavor reversion refers to the onset of distinct, objectionable off-flavors in refined vegetable oils, such as soybean oil, caused by extremely mild oxidative degradation of unsaturated fatty acids, particularly linolenic acid. This phenomenon occurs before typical oxidative rancidity develops, producing grassy, beany, or fishy flavor notes that severely degrade the sensory quality of the refined lipid.

51. (A) It contains phycocyanin, a protein-based pigment that denatures irreversibly during heating.
Spirulina extract owes its vibrant blue color to phycocyanin, which is a water-soluble phycobiliprotein complex. During thermal pasteurization, the high heat denatures the protein structure of phycocyanin, causing it to unfold and lose its light-absorbing conformation. This irreversible structural collapse results in the degradation of the blue color into an unappealing, dull grey hue.

NODIA

52. (A) P-III, Q-I, R-IV, S-II
Monosodium glutamate enhances the savory umami taste, maltol provides a sweet, caramel-like aroma, and vanillin is the primary component of vanilla flavor. Diacetyl is a highly volatile butter flavor compound that poses a severe inhalation hazard to workers during industrial manufacturing. This correct pairing connects each flavor compound to its distinctive sensory or physiological characteristic.

53. (A) Mint - Menthol
Menthol is the primary active monoterpene alcohol found in mint essential oil, responsible for its characteristic cooling sensation and aroma. Conversely, eugenol is the major component of clove oil, piperine provides pungency to black pepper, and capsaicin is responsible for the heat in chillies. This makes the mint and menthol pair chemically correct.

36. (C) Microencapsulation using spray drying with gum arabic
Volatile citrus essential oils are highly susceptible to chemical oxidation and evaporative loss during storage. Microencapsulation via spray drying utilizing gum arabic as a carrier matrix represents the most effective technology. This process entraps the volatile oil droplets inside a protective, solid carbohydrate shell, which acts as a barrier against oxygen, heat, and light, thereby extending product shelf life.

37. (A) P-II, Q-III, R-IV, S-I
HPLC is used to quantify non-volatile synthetic colors, while GC-MS is the gold standard for volatile flavor compounds. Spectrophotometry measures absorbance to determine total pigments, and TLC provides rapid, qualitative screening of synthetic dyes. This mapping aligns each analytical method with its primary application, ensuring precise quality control and regulatory compliance in food testing laboratories.

38. (D) Cinnamaldehyde - Cinnamon bark
Cinnamaldehyde is the primary volatile organic compound found naturally in the essential oil extracted from cinnamon bark, responsible for its distinct warm aroma and flavor. Conversely, vanillin is derived from vanilla beans, eugenol is the main constituent of clove oil, and menthol is obtained from mint species. This highlights the importance of matching active flavor constituents with their botanical sources.

39. (B) It undergoes photo-oxidation, generating off-flavors known as "sunlight flavor."
Riboflavin is a highly photosensitive water-soluble vitamin that acts as a photosensitizer when exposed to high-intensity light. It absorbs light energy and catalyzes the photo-oxidation of lipids and proteins in milk, particularly converting methionine to methional. This chemical process generates objectionable off-flavors, historically and industrially referred to as sunlight flavor, reducing milk quality and consumer acceptability.

40. (C) Non-permitted industrial dye linked to testicular damage and systemic carcinogenicity.
Metanil Yellow is a synthetic diarylazo dye primarily intended for textile coloration and is strictly prohibited in food products. Toxicology studies have linked metanil yellow exposure to adverse health effects, including testicular damage, neurotoxicity, and systemic carcinogenicity. Its fraudulent use as an adulterant to impart a bright yellow color to food represents a severe food safety violation.

41. (A) Both Statement I and Statement II are true.
The Codex Alimentarius Commission establishes international science-based food standards, including guidelines for the safe use of coloring and flavoring agents. Food safety regulations globally mandate that the addition of artificial flavors must be explicitly declared on consumer labels. This ensures transparency, allows consumers to make informed choices, and prevents deceptive marketing practices regarding the nature of ingredients.

42. (A) Holding at freezing temperatures (-18°C) in the dark
Maintaining foods at freezing temperatures in the absence of light minimizes thermal energy and photo-oxidation, which significantly preserves the structural integrity of sensitive anthocyanin pigments. Conversely, high-temperature pasteurization, exposure to atmospheric oxygen, and chemical sulfiting are aggressive processing treatments that rapidly accelerate the degradation, cleavage, or bleaching of water-soluble anthocyanin molecules within food systems.

43. (B) Addition of magnesium or zinc salts to form highly stable metallo-chlorophyll complexes.
Thermal processing displaces the natural magnesium ion from chlorophyll, resulting in olive-brown pheophytin. Introducing divalent zinc or copper salts during processing allows these metals to insert into the porphyrin ring. This forms zinc or copper complexes that are highly stable under extreme heat, retaining the green color of thermally processed vegetables like peas.

44. (B) Diacetyl - Caramelisation of pure sucrose
Diacetyl is not a primary product of the caramelization of pure sucrose, but is typically generated through microbiological fermentation by lactic acid bacteria or specific yeast pathways. Acrylamide is formed via the Maillard reaction between reducing sugars and asparagine, pyrazines arise from high-temperature roasting, and allicin is produced enzymatically when garlic tissue is crushed, making this pair incorrect.

Downloaded from www.pdf.tube

their chemical structures and bonds are identical to those of natural extracts, the human digestive system metabolizes them using the exact same enzymatic pathways. They are highly cost-effective and safe, making the claim of containing non-metabolizable bonds completely false.

64. (A) Both A and R are true and R is the correct explanation of A.
The Maillard reaction is intentionally promoted during the roasting of coffee beans and the baking of bread crusts. This non-enzymatic reaction between reducing sugars and amino acids synthesizes complex nitrogenous brown polymers called melanoidins, alongside aromatic volatile compounds like pyrazines and furans. These compounds are directly responsible for the desirable color and rich, roasted flavor profiles.

65. (B) The daily intake level of an additive over a lifetime that presents no appreciable health risk to consumers.
Acceptable Daily Intake is defined as an estimate of the amount of a food additive, expressed in milligrams per kilogram of body weight, that can be ingested daily over a lifetime without posing any appreciable risk to consumer health. It is established by expert toxicological panels using extensive scientific data from animal studies and human clinical evaluations.

66. (D) The cake will be much paler and lack baked flavors because the Maillard reaction requires a reactive reducing sugar.
Sucralose is a non-reducing chlorocarbon that does not possess the free carbonyl group required to initiate the Maillard browning cascade. Replacing reducing sugars with non-reducing sweeteners prevents the condensation reaction with amino acids. Consequently, the baked cake will remain pale and lack the rich, roasted, and caramelized flavor notes characteristic of traditionally baked goods.

67. (A) P-III, Q-II, R-I, S-IV
Spray drying atomizes an emulsion into a hot gas, coacervation involves the phase separation of hydrocolloids, extrusion forces mixtures through a die into a dehydrating medium, and freeze drying utilizes ice sublimation under vacuum. This logical classification pairs each encapsulation technique with its unique mechanical or physical processing description, helping formulators select the correct method.

68. (C) Lutein - Protection against age-related macular degeneration
Lutein is a naturally occurring xanthophyll carotenoid that selectively accumulates in the macular region of the human retina. Scientific evidence demonstrates that lutein filters high-energy blue light and acts as a powerful antioxidant, protecting retinal tissues from oxidative stress and significantly reducing the risk of developing age-related macular degeneration, which is a leading cause of vision loss.

69. (A) Photo-oxidation of riboflavin and methionine, producing a “sunlight” off-flavor.
Exposing milk to fluorescent light initiates photo-oxidation catalyzed by riboflavin, which absorbs light energy and transfers it to oxygen. This active oxygen oxidizes milk lipids and proteins, particularly degrading methionine into volatile methional. This chemical reaction is responsible for producing the highly undesirable sunlight off-flavor, which degrades the sensory quality of liquid milk.

70. (D) It is a strictly prohibited, toxic industrial dye used fraudulently to achieve pink hues.
Rhodamine B is a synthetic basic dye primarily utilized in industrial applications such as paper dyeing and printing. It is strictly prohibited as a food additive due to its documented toxicity, mutagenic potential, and suspected carcinogenicity. Its fraudulent addition to candies to achieve a vibrant pink coloration constitutes a severe regulatory violation and food safety hazard.

NODIA

71. (C) Statement I is true but Statement II is false.
Tartrazine is a synthetic yellow food dye associated with allergic-type reactions, such as hives and asthma, particularly in individuals with aspirin sensitivity. Despite these health concerns, tartrazine is not banned globally; instead, it is permitted under strict regulations in many countries, provided its presence is clearly declared on product labels, making the second statement false.

72. (C) Indigo Carmine
Indigo Carmine is a synthetic food colorant belonging to the indigoid class that produces a distinct, deep blue hue in food applications. Conversely, Carmoisine, Ponceau 4R, and Erythrosine are approved synthetic colorants designed specifically to yield red, pink, or cherry-

red shades. Distinguishing colorants by their hue is fundamental for formulation planning and labeling compliance.

73. (D) They guarantee batch consistency, cost-efficiency, and a stable supply free from agricultural limits.
Nature-identical flavoring substances are highly favored in large-scale food manufacturing because they can be synthesized reliably with high purity. This chemical synthesis guarantees absolute batch-to-batch sensory consistency and high cost-efficiency. It also ensures a stable industrial supply that remains entirely independent of seasonal agricultural variations, weather disruptions, crop diseases, or geopolitical trade limitations.

74. (A) Freeze-drying - Completely destroys carotenoids due to sublimation
Freeze-drying does not destroy carotenoids through sublimation. Sublimation describes the physical transition of water from solid ice to gas under vacuum, which is highly effective at preserving carotenoids by avoiding high heat. However, carotenoids can undergo slow oxidation if exposed to oxygen during storage. Other processing pairs, such as thermal chlorophyll degradation, are correctly described.

75. (B) Cite the product for misbranding because E110 is Sunset Yellow, a synthetic artificial colour.
E110 represents Sunset Yellow, which is a synthetic coal-tar-derived azo dye. Labeling a product as 100% Natural Organic Fruit Juice while incorporating synthetic chemical colorants violates food standards. Regulatory agencies must cite the product for misbranding and adulteration, as the use of artificial additives directly contradicts organic certification standards and misleads consumers.

76. (B) I, II, and IV
Caramelization involves sugar degradation without amino acids, and Strecker degradation is a crucial Maillard step producing aromatic aldehydes. High-moisture environments inhibit advanced Maillard browning by diluting reactants. However, boiling meat at 100°C does not generate more intense browning than grilling at 200°C because browning is highly favored by elevated temperatures, making statement III incorrect.

77. (A) Oxymyoglobin
Oxymyoglobin is the oxygenated form of myoglobin, where iron remains in the ferrous state and is coordinated with oxygen. This chemical state is directly responsible for the bright cherry-red color of fresh meat that consumers associate with quality. Packaging strategies like modified atmosphere packaging aim to maintain high oxygen levels to stabilize this red color.

78. (C) It exhibits high solubility in cold, acidic water.
Curcumin is a highly hydrophobic polyphenolic compound that is practically insoluble in cold, acidic water, dissolving only in organic solvents, oils, and highly alkaline aqueous solutions. It is the primary antioxidant pigment in turmeric and is sensitive to alkaline conditions, turning reddish-brown, which makes the statement regarding its high solubility in cold, acidic water chemically incorrect.

79. (A) Both A and R are true and R is the correct explanation of A.
Encapsulating volatile flavors within a solid maltodextrin matrix significantly extends the shelf life of dry soup mixes. Maltodextrin acts as a highly effective physical barrier that restricts oxygen penetration, preventing oxidative degradation of sensitive flavor components. It also physically blocks the volatilization and escape of aroma molecules, keeping them locked inside the powder during dry storage.

80. (C) The non-enzymatic thermal degradation pathway of pure carbohydrates heated at high temperatures.
Caramelization is defined as a non-enzymatic browning pathway that occurs when pure carbohydrates are heated to high temperatures without any nitrogenous compounds. The process involves thermal degradation, dehydration, and isomerization of sugars, yielding volatile compounds that contribute to characteristic caramel aromas and complex polymeric pigments responsible for the rich brown color of caramelized foods.

81. (B) Brushing the dough with an alkaline solution (like lye or baking soda) before baking.
The Maillard reaction is highly accelerated under alkaline conditions because elevated pH levels promote the deprotonation of amino groups on proteins and amino acids. This increases their nucleophilic strength, making them highly

Click Here to Buy book on Amazon

reactive toward carbonyl groups of reducing sugars. Brushing dough with lye or baking soda prior to baking rapidly accelerates browning and flavor development.

82. (A) P-II, Q-III, R-I, S-IV
E102 is the designated European code for the yellow azo dye Tartrazine, E124 corresponds to the red dye Ponceau 4R, E133 represents Brilliant Blue FCF, and E150d corresponds to Class IV sulfite ammonia caramel. This systematic classification connects each unique E-number to its chemical name, ensuring precise regulatory compliance and standardized ingredient declarations.

83. (A) "Popcorn lung" (Bronchiolitis obliterans) - Diacetyl
Diacetyl is a highly volatile butter flavor compound that has been linked to Bronchiolitis obliterans, also known as popcorn lung, when chronically inhaled by workers in industrial manufacturing plants. Conversely, 4-methylimidazole is generated in caramel classes III and IV, not class I, and anthocyanins do not cause hyperactivity, making the first pair the only correct toxicological concern.

84. (B) It bleaches the natural anthocyanin pigments, causing a severe loss of red color.
Adding high concentrations of sulfur dioxide as a preservative to strawberry jam leads to a chemical reaction where bisulfite ions nucleophilically attack the carbon at position 4 of the anthocyanin flavylium cation. This reaction breaks the conjugated double-bond system of the pigment, converting the vibrant red anthocyanin into a colorless sulfonic acid adduct, resulting in bleaching.

85. (A) Adding zinc or copper salts to form stable metallo-porphyrin complexes.
Thermal processing during retorting typically causes the loss of the central magnesium ion from chlorophyll, converting it to olive-brown pheophytin. Introducing food-grade zinc or copper salts allows these metal ions to insert into the vacant porphyrin ring of the degraded pigment. This forms metallo-chlorophyll complexes that are highly stable under extreme heat, retaining the green color.

86. (C) Statement I is false but Statement II is true.
Monosodium glutamate is not banned in commercially produced foods; it is globally recognized as a safe food additive under specified limits. However, the term Chinese Restaurant Syndrome was controversially coined to describe a range of transient physical symptoms, including headaches and chest tightness, associated with its intake, although scientific reviews find no consistent link, making the first statement false.

87. (B) Extremely high tinctorial strength requiring very low dosage.
Natural coloring agents typically possess significantly lower tinctorial strength compared to synthetic dyes, requiring much higher concentrations to achieve equivalent color intensity. Their advantages include clean-label appeal, health-promoting properties like antioxidant activity, and the absence of links to behavioral hyperactivity in children. This makes the claim of extremely high tinctorial strength an incorrect advantage.

88. (C) Blending the volatile flavors into the syrup during the cooling phase before molding.
Volatile natural flavors are highly susceptible to thermal degradation and rapid evaporation if exposed to the extreme heat of sugar boiling. Introducing these delicate flavor compounds during the cooling phase of the syrup, just prior to molding, minimizes thermal exposure. This process preserves the aromatic profile and prevents volatile loss, ensuring high-quality confectionery products.

NODIA

89. (D) Monosodium glutamate (MSG) - Derived exclusively from synthetic petroleum byproducts
Monosodium glutamate is not synthesized from petroleum byproducts; it is produced through industrial bacterial fermentation of carbohydrate-rich agricultural feedstocks, such as sugar beet, sugar cane, or molasses, using strains like Corynebacterium glutamicum. The other pairs correctly describe flavor nucleotides and their typical sources, making the petroleum-derived statement chemically incorrect.

90. (A) The product is misbranded and adulterated, as E122 is Carmoisine, a synthetic azo dye.
E122 is Carmoisine, which is a synthetic red azo dye derived from petroleum. Finding this synthetic dye in a bakery product labeled as containing no added synthetic colors constitutes a serious regulatory violation. The food product is classified as misbranded and adulterated under food safety laws, as the label directly misleads

under strict maximum limits, making the assertion true but the reason completely false.

110. (C) Volatile plant liquids containing aromatic compounds obtained by distillation.
Essential oils are concentrated, volatile liquids containing hydrophobic aroma compounds extracted from botanical raw materials. They are obtained primarily through physical extraction methods, most notably steam distillation or mechanical cold pressing. These oils contain the characteristic, concentrated aromatic profiles of the source plants and are widely utilized as natural flavorings in foods.

111. (D) 0.6 and 0.8
The Retardation Factor in thin-layer chromatography is calculated by dividing the distance traveled by the individual solute spot by the total distance traveled by the solvent front. For a solvent front of ten centimeters, the red dye moving six centimeters yields a value of 0.6, and the yellow dye moving eight centimeters yields a value of 0.8.

112. (A) P-III, Q-I, R-IV, S-II
Anthocyanins degrade in alkaline conditions, chlorophyll loses its magnesium ion under heat and acid, curcumin is highly sensitive to light, and beta-carotene degrades via oxidation due to its conjugated double bonds. This correct mapping links each natural coloring agent to its primary chemical stability challenge encountered during food processing and storage.

113. (B) Smoky, burnt notes in dark caramel - Severe Caramelisation
Severe caramelization involves the high-temperature thermal degradation of pure carbohydrates, which generates complex volatile compounds like furans and cyclopentenolones. These compounds are responsible for the smoky, burnt, and bittersweet flavor notes characteristic of dark caramel. The other pairs represent incorrect pathways for generating those specific flavors, making the caramelization pair correct.

114. (D) The powder will absorb moisture, accelerating Maillard browning to yield hard, dark clumps.
Onion powder is highly hygroscopic, and storing it in high humidity causes rapid moisture absorption. This elevates the water activity into the optimal 0.6 to 0.8 range, which increases reactant mobility and accelerates the Maillard browning reaction. This non-enzymatic reaction, combined with physical caking, turns the dry powder into hard, dark, degraded clumps.

115. (A) It extracts only volatile, lipophilic compounds while leaving non-volatile and water-soluble notes behind.
Steam distillation extracts only the volatile, hydrophobic, and lipophilic compounds from cloves, such as eugenol, while leaving behind the non-volatile, water-soluble, and polar compounds that contribute to the full sensory profile of the raw spice. This partial extraction explains why distilled essential oils often lack the complex, rounded aroma of the original botanical material.

116. (A) Both Statement I and Statement II are true.
Sunset Yellow is a widely utilized synthetic food dye that produces a vibrant orange-yellow hue in various food and beverage products. Chemically, it belongs to the azo dye class, which is characterized by the presence of a functional azo group containing a nitrogen-nitrogen double bond. This structure provides high color stability and tinctorial strength.

117. (A) Sublimation of flavors within the high-pressure extruder barrel.
High-temperature extrusion cooking leads to flavor loss through sudden flash volatilization at the die exit, thermal degradation of sensitive molecules, and chemical binding with starches or proteins. However, true sublimation, which is the direct transition of a solid to a gas, does not occur within the high-pressure extruder barrel, making this an incorrect mechanism.

118. (D) Blanching the potato slices in hot water prior to frying to leach out reactive sugars and asparagine.
Blanching potato slices in hot water prior to frying leaches out water-soluble reducing sugars and the free amino acid asparagine from the potato tissue. Removing these key precursors directly limits the Maillard reaction cascade during subsequent high-temperature frying, effectively minimizing the formation of the toxic byproduct acrylamide in the finished potato crisps.

119. (B) Umami - A sweet, intensely sugary taste perception
Umami does not describe a sweet, intensely sugary taste perception; rather, it represents a savory, brothy, or meaty taste sensation triggered

Downloaded from www.pdf.tube

during baking, roasting, or frying potato products, toasted cereals, and coffee beans.

100. (C) Metanil Yellow
Metanil Yellow is an industrial azo dye frequently used fraudulently as an adulterant in turmeric powder. When treated with concentrated hydrochloric acid, the azo group undergoes protonation, converting the yellow compound into a highly stable quinonoid structure that exhibits a vibrant magenta coloration. This rapid chemical transition serves as a standard qualitative test for detecting this adulterant.

101. (C) Statement I is true but Statement II is false.
Cochineal extract, or Carmine, is a highly stable natural red pigment extracted from the dried bodies of female Dactylopius coccus insects. Because of its insect origin, Carmine is not acceptable in vegan, vegetarian, halal, or kosher food formulations. This makes the first statement true and the second statement false under standard dietary guidelines.

102. (D) Carbonated fruit beverages
Carbonated fruit beverages represent a processed food category where the addition of permitted synthetic colors is generally allowed under strict regulatory limits. Conversely, fresh fruits, vegetables, raw meats, and pasteurized milks are staple, unprocessed foods where adding synthetic colors is prohibited to prevent consumer deception regarding product freshness, quality, and origin.

103. (B) It protects volatile flavors from high thermal damage by using solid lipid-based carrier matrices instead.
Spray chilling utilizes solid lipid-based carrier matrices instead of aqueous polymer solutions, allowing microencapsulation to occur at low temperatures through lipid solidification rather than heat evaporation. This technique protects highly thermolabile and volatile flavor compounds from the heat damage associated with spray drying, ensuring high flavor retention in fatty or low-temperature food formulations.

104. (C) Spirulina - Betanin
Spirulina is a blue-green microalga whose primary pigment is phycocyanin, which is a water-soluble protein complex, not betanin. Betanin is a nitrogenous red pigment obtained from beetroot. Conversely, crocin, bixin, and capsanthin are correctly matched with saffron, annatto, and paprika, respectively, making the spirulina and betanin pair biochemically incorrect.

105. (D) 150 mg
The Acceptable Daily Intake represents the safe consumption limit calculated relative to body weight. For a child weighing twenty kilograms, with a tartrazine ADI of 7.5 milligrams per kilogram, the maximum safe daily intake is calculated by multiplying the child's weight by the ADI value. This calculation yields a maximum safe intake of 150 milligrams of tartrazine per day.

106. (B) I, III, and IV
Anthocyanins exhibit optimal stability under highly acidic conditions, can form stable complexes through copigmentation, and undergo thermal degradation at high temperatures. However, the presence of ascorbic acid does not always protect them; instead, it can accelerate their degradation via mutual oxidative pathways, making the second statement incorrect under typical processing conditions.

107. (B) Esters
Esters are a prominent class of volatile organic compounds synthesized naturally in fruits through metabolic pathways during ripening. These compounds possess highly characteristic sweet, fruity, and floral aromatic profiles. Examples include isoamyl acetate in bananas and ethyl butyrate in pineapples, making esters the primary chemical class responsible for fruity aromas in food products.

108. (B) Synthetic colours often carry a complex, appealing inherent flavour.
Synthetic food colorants are highly purified chemical dyes designed specifically to be completely odorless and tasteless, ensuring they do not introduce any objectionable flavors to food systems. Their advantages include superior stability to light, heat, and pH, along with high tinctorial strength and lower production costs. This makes the claim of possessing an inherent flavor incorrect.

109. (C) A is true but R is false.
The food industry is experiencing a major shift toward clean-label natural colors due to rising consumer demand for wholesome ingredients. However, regulatory agencies have not mandated any complete global ban on all synthetic colors. Permitted synthetic colors remain legally allowed

NODIA

sweetened, vitamin-fortified fruit juice.
(C) Introducing boiled eggs or a thick, protein-dense legume preparation to the meal.
(D) Increasing the physical portion size of the polished white rice in each serving.

7. Which of the following statements incorrectly classifies a food item based on its primary nutritional function?
(A) Green leafy vegetables are primarily energy-yielding foods.
(B) Cereals and millets are primarily energy-yielding foods.
(C) Poultry, meat, and pulses are primarily body-building foods.
(D) Fresh citrus fruits are primarily protective dietary foods.

8. Match the nutrient in List I with its primary dietary source in List II.
List I: (Nutrient)
P. Vitamin C
Q. Heme Iron
R. Calcium
S. Iodine
List II: (Primary Dietary Source)
I. Dairy products
II. Citrus fruits
III. Iodized salt
IV. Red meat
(A) P-II, Q-IV, R-I, S-III
(B) P-IV, Q-II, R-III, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-I, Q-IV, R-II, S-III

9. High consumption of processed foods rich in trans fats directly alters lipid profiles in humans. Which of the following is the most likely physiological effect of this dietary pattern?
(A) Increase in High-Density Lipoprotein (HDL) and decrease in Low-Density Lipoprotein (LDL) levels.
(B) Decrease in High-Density Lipoprotein (HDL) and increase in Low-Density Lipoprotein (LDL) levels.
(C) Simultaneous elevation of all high-density fractions and total suppression of blood chylomicrons.
(D) Rapid and direct conversion of all dietary trans fatty acids into glycogen stored within hepatocytes.

10. Which of the following pairs of nutrient and its classification is correctly matched?
(A) Copper - Primary dietary macronutrient
(B) Linoleic acid - Non-essential fatty acid
(C) Potassium - Major macromineral nutrient
(D) Thiamine - Fat-soluble organic vitamin

11. Arrange the following food items in ascending order of their typical biological value (BV) for protein.
1. Whole Egg
2. Wheat
3. Soybeans
4. Milk
(A) 2, 3, 4, 1
(B) 3, 2, 1, 4
(C) 2, 4, 3, 1
(D) 4, 3, 2, 1

12. All of the following are considered protective nutrients essential for reducing oxidative stress in the body, EXCEPT:
(A) Palmitic acid
(B) Ascorbic acid
(C) Alpha-tocopherol
(D) Selenium

13. A community health survey reveals that a specific demographic relies exclusively on maize as their staple food, with negligible intake of legumes or dairy. What specific nutritional risk is most highly associated with this dietary pattern?
(A) Scurvy due to an absolute lack of fresh fruits and dietary Vitamin C.
(B) Pellagra due to a deficiency in bioavailable niacin and tryptophan.
(C) Beriberi due to an excess of thiaminase enzymes present in raw maize.
(D) Rickets due to severely impaired intestinal calcium mineral absorption.

14. What is the most appropriate indicator of a protein's quality in human nutrition?
(A) The total elemental nitrogen content measured per gram of the food item.
(B) The PDCAAS or DIAAS rating of the ingested dietary protein source.
(C) The mechanical digestibility of the protein structure in the stomach.
(D) The precise ratio of branched-chain amino acids to total matrix lipids.

Click Here to Buy book on Amazon

primarily by glutamates and nucleotides. Sugariness is perceived via distinct sweetness receptors. Conversely, pungency, astringency, and cooling are correctly paired with their physical and sensory definitions, making the umami description incorrect.

120. (C) The claim is false because Ethyl Vanillin is a well-known artificial flavouring agent, not found in nature.
Ethyl vanillin is a fully synthetic compound that is significantly more potent than natural vanillin and is not found naturally in any plant or animal tissue. Detecting ethyl vanillin in a product claiming zero artificial flavors proves the use of synthetic additives, rendering the label claim fraudulent and in violation of food labeling regulations.

121. (B) I, III, and IV.
Codex Alimentarius provides international guidance, MSG is prohibited in infant pastas, and JECFA conducts independent risk assessments to establish ADI values. However, synthetic colors like Sunset Yellow are strictly prohibited in infant milk substitutes to protect developing infants, making the second statement incorrect and statements I, III, and IV the only correct regulatory facts.

122. (A) Lipoxygenase
Lipoxygenase is a highly active enzyme that catalyzes the oxidation of polyunsaturated fatty acids, producing hydroperoxides that break down into volatile aldehydes and ketones. If not inactivated by thermal blanching, this enzymatic activity continues during frozen storage, generating undesirable hay-like or cardboard-like off-flavors that degrade the quality of frozen green beans.

123. (B) Synthetic vanillin is structurally completely different from natural vanillin.
Synthetic vanillin is not structurally different from natural vanillin; they are chemically and molecularly identical, sharing the exact same chemical structure. Vanillin is the primary aroma compound in vanilla beans and can be synthesized from lignin or guaiacol. The claim that synthetic vanillin possesses a completely different chemical structure is incorrect.

124. (A) Both A and R are true and R is the correct explanation of A.
Exposing raw meat to air for extended periods causes the bright red oxymyoglobin to undergo oxidation. This chemical process oxidizes the central iron atom of the heme ring from the ferrous state to the ferric state, converting the pigment into metmyoglobin. This oxidation is directly responsible for the undesirable color shift from bright red to brown.

125. (A) The percentage of core flavor compound successfully trapped inside the finished microcapsules.
Encapsulation efficiency is defined as the percentage of the active core flavor compound that is successfully entrapped and retained inside the protective wall matrix of the finished microcapsules, relative to the total flavor added during formulation. This parameter serves as a key performance indicator for evaluating the quality and economic viability of encapsulation processes.

126. (C) Blending cold-processed spirulina and safflower extracts under non-thermal conditions.
Blending blue phycocyanin from spirulina and yellow chalconoids from safflower extract creates a vibrant, natural green hue. Utilizing cold-processing and non-thermal conditions is essential, as phycocyanin is a highly heat-sensitive protein pigment that denatures under thermal treatment. This approach provides a stable, clean-label green color suitable for clear, acidic sports drinks.

127. (A) P-II, Q-I, R-III, S-IV
Blanching inactivates enzymes to preserve color and flavor, roasting generates complex Maillard and caramelization profiles, sulfiting prevents enzymatic browning but can bleach red anthocyanins, and fermentation yields sour lactic acid notes. This logical mapping connects each common food processing operation directly to its primary intended physical or chemical effect on color or flavor.

128. (C) Beta-carotene - Hexane or edible oils
Beta-carotene is a highly lipophilic tetraterpene hydrocarbon pigment that is completely insoluble in water. Consequently, its industrial extraction from natural sources requires non-polar solvents like hexane or edible oils. Conversely, polar pigments like anthocyanins require polar solvents,

Downloaded from www.pdf.tube

consumers regarding the true nature of the ingredients.

91. (A) I, II, and III
Chlorophylls degrade in acid but are stable in alkaline conditions, betalains are more stable than anthocyanins in low-acid systems, and carotenoids are highly susceptible to oxidation. However, anthocyanins are highly heat-sensitive and undergo rapid cleavage during boiling, turning brown or colorless, which makes the fourth statement incorrect under standard food processing conditions.

92. (B) Gas Chromatography-Mass Spectrometry (GC-MS)
Gas Chromatography-Mass Spectrometry is globally recognized as the gold standard for analyzing volatile flavor compounds. The gas chromatograph separates complex, volatile mixtures based on boiling point and column affinity, while the mass spectrometer provides precise structural identification of each compound. This offers unmatched sensitivity and selectivity required for detecting trace aromatic compounds in food matrices.

93. (A) Synthetic colours are freely permitted in infant formulas to make them visually appealing to babies.
Synthetic food colorants are strictly prohibited in infant formulas because developing infant physiological systems are highly vulnerable to chemical additives. Permitted synthetic colors are restricted to maximum limits around 100 mg/kg in general foods and require clear label declarations. The claim that synthetic dyes are freely permitted in infant formulas is completely incorrect.

94. (A) Both A and R are true and R is the correct explanation of A.
Cooking tomatoes disrupts the cell walls and chromoplast matrices, releasing entrapped lycopene. Because lycopene is a highly hydrophobic, lipophilic carotenoid, it dissolves readily in dietary fats added during cooking. This dissolution changes its physical state and promotes cis-isomerization, making it significantly more accessible for micellar incorporation and absorption in the human digestive tract.

95. (D) The effect where two flavor enhancers together produce an intensity far exceeding their individual sum.
Taste synergism describes a sensory phenomenon where combining two distinct flavor compounds produces a taste response that is significantly greater than the sum of their individual intensities. A classic industrial example is the combination of monosodium glutamate and purine nucleotides, which binds synergistically to taste receptors, intensely amplifying the overall perception of savory umami taste.

96. (C) Combine glutamate with nucleotides to exploit synergistic flavor-enhancing relationships.
To maximize savory intensity while keeping sodium levels within regulatory limits, manufacturers should combine glutamates with purine nucleotides like disodium inosinate and guanylate. These compounds act synergistically to bind umami taste receptors, producing a savory sensation far greater than the sum of their individual parts. This enables a significant reduction in overall salt content.

NODIA

97. (A) P-IV, Q-II, R-III, S-I
Matching synthetic colorants with their standard culinary applications connects Fast Green FCF to green mint syrup, Sunset Yellow to orange drinks, Erythrosine to cherry preserves, and Tartrazine to lemon candies. This mapping reflects standard industrial usage, as synthetic dyes are selected based on their specific hue and physical stability within different food matrices.

98. (D) Ethyl maltol - Artificial flavouring agent
Ethyl maltol is a synthetic organic compound that does not occur naturally in any plant or animal tissue, categorizing it strictly as an artificial flavoring agent. Conversely, vanillin from vanilla pods is a natural flavor, while linalool from coriander and industrially synthesized diacetyl are categorized as natural and nature-identical, respectively, making ethyl maltol the correct pair.

99. (A) Heating foods rich in asparagine and reducing sugars forms acrylamide.
Acrylamide is a toxic chemical byproduct generated primarily through the non-enzymatic Maillard reaction when foods containing high levels of the free amino acid asparagine and reducing sugars are heated at temperatures exceeding 120 degrees Celsius. This chemical reaction occurs commonly

approved and widely utilized in acidic beverages like colas under strict regulatory limits for its byproduct, 4-methylimidazole. Other caramel classes, such as Class I, are correctly described, making the universal ban claim incorrect.

139. (A) Both A and R are true and R is the correct explanation of A.
Adding nitrites or nitrates to meat formulations leads to the formation of nitric oxide, which coordinates with myoglobin to yield nitrosomyoglobin. Upon thermal processing, this compound denatures to form nitrosylhemochrome. This stable pink coordination complex is highly resistant to heat, preserving the characteristic pink coloration of cured meats like ham during cooking.

140. (B) A descriptive sensory method detailing all flavor attributes, intensities, and order of appearance.
Flavor Profile Analysis is a highly standardized, descriptive sensory evaluation methodology where a panel of trained judges identifies and rates individual flavor attributes. The panel documents the intensity, order of appearance, and aftertaste of each sensory note in a food product, providing a comprehensive, reproducible profile of its overall flavor characteristics.

141. (A) Using aroma recovery during evaporation and blending the recovered volatiles back into the clear juice.
To produce a clear, transparent apple juice that retains its natural aroma, manufacturers utilize aroma recovery systems during thermal evaporation. These systems capture the highly volatile aroma compounds from the vapor phase before they are lost. Blending these recovered volatiles back into the clarified juice restores its fresh, natural sensory profile without introducing cloudiness.

142. (A) P-III, Q-I, R-II, S-IV
Warmed-over flavor arises from phospholipid autoxidation during refrigeration, sunlight flavor in milk involves riboflavin photo-oxidation, hay-like defects in unblanched vegetables stem from enzymatic lipoxygenase activity, and frying oil rancidity arises from triglyceride degradation. This correct mapping links each flavor defect directly to its primary underlying chemical or enzymatic cause.

143. (D) Ethyl butyrate - Ester
Ethyl butyrate is an organic compound that contains an ester functional group, which is responsible for its characteristic sweet, fruity aroma of pineapple. Conversely, diacetyl is a ketone, vanillin is a phenolic aldehyde, and cinnamaldehyde is an aldehyde. This makes the ethyl butyrate and ester pair chemically correct under standard IUPAC classification.

144. (C) Adding artificial color can easily mask structural defects and age, thus misleading the consumer.
Prohibiting artificial colors in fresh, raw produce is a fundamental consumer protection measure. Adding colorants to raw fruits and vegetables could mask physical defects, spoilage, or age, giving a false impression of freshness and quality. This restriction ensures transparency and prevents deceptive practices that could mislead consumers regarding the safety and grade of fresh foods.

145. (B) Tartrazine (E102)
Tartrazine is a synthetic yellow azo dye commonly used in confectionery products. Clinical and toxicological studies have linked tartrazine exposure to adverse hypersensitivity reactions, including urticaria, dermatitis, and bronchoconstriction, especially in individuals with pre-existing aspirin sensitivity. Therefore, detecting tartrazine in foods that trigger these specific reactions is highly expected under medical guidelines.

146. (A) Both Statement I and Statement II are true.
Volatile flavor compounds can interact chemically with food proteins through hydrophobic or covalent binding, leading to a reduction in perceived flavor intensity. Simultaneously, carbohydrates like starch can physically trap volatile flavor molecules inside their helical structures to form stable inclusion complexes. Both statements accurately describe how food matrix components physically and chemically alter flavor perception.

147. (A) Polyphenol oxidase
The Maillard reaction is a non-enzymatic browning pathway that requires a reducing sugar, an amino group from a protein or amino acid, and water. Conversely, polyphenol oxidase is an enzyme responsible for enzymatic browning in fresh-cut fruits and vegetables. Therefore, polyphenol oxidase is completely unnecessary for initiating the chemical Maillard browning cascade.

Click Here to Buy book on Amazon

making the beta-carotene and lipophilic solvent pair chemically correct.

129. (B) It imparts a rich buttery flavor, but chronic inhalation can cause severe obstructive lung disease.
Adding diacetyl to microwave popcorn provides a highly desirable, rich buttery flavor and aroma. However, chronic inhalation of volatile diacetyl vapors by workers in manufacturing plants is linked to the development of Bronchiolitis obliterans, which is a severe, irreversible obstructive lung disease. This represents a critical occupational safety concern in the food industry.

130. (D) The product must explicitly declare "Smoke Flavoring" in the ingredients list.
Food regulations require that any product utilizing condensed liquid smoke to impart a smoky flavor must explicitly declare smoke flavoring in its ingredients list. This ingredient declaration ensures proper consumer information, prevents misleading marketing, and maintains compliance with food additive labeling standards regarding the addition of non-traditional aromatic preparations.

131. (C) Statement I is true but Statement II is false.
The Maillard reaction rate peaks within the intermediate water activity range of 0.6 to 0.7, where reactant mobility is optimized. However, lipid oxidation does not follow this same curve; its rate is high at extremely low water activities, reaches a minimum around 0.3, and increases again at higher levels, making the second statement false.

132. (C) High-Pressure Processing (HPP)
High-Pressure Processing is a non-thermal pasteurization technology that subjects packaged foods to high hydrostatic pressures. Because it does not rely on thermal energy, HPP inactivates vegetative microorganisms while leaving low-molecular-weight covalent bonds intact. This preserves delicate natural pigments, volatile flavor compounds, and nutritional vitamins far better than conventional thermal processing methods.

133. (A) High-Performance Liquid Chromatography (HPLC) equipped with a Diode Array Detector (DAD).
High-Performance Liquid Chromatography coupled with a Diode Array Detector is the most widely adopted and legally robust method for identifying and quantifying multiple synthetic food colors. This technique separates individual dyes within complex food matrices, while the detector measures their distinct visible absorption spectra, ensuring high sensitivity and accurate quantification for regulatory compliance.

134. (D) Beta-carotene → Thermal isomerisation (Bright Blue)
Thermal isomerisation of beta-carotene does not produce a bright blue color; instead, it causes a slight fading of the yellow-orange hue due to trans-to-cis conformational shifts. Chlorophyll, anthocyanins, and oxymyoglobin are correctly matched with their degradation pigments and colors, making the beta-carotene and bright blue pair chemically incorrect.

135. (B) Annatto contains bixin which can be chemically saponified into water-soluble norbixin.
Annatto seeds naturally contain bixin, which is a fat-soluble carotenoid pigment. To obtain a water-soluble coloring agent, bixin is chemically saponified using aqueous alkaline solutions. This process cleaves the methyl ester group of bixin, converting it into norbixin, which is a water-soluble dicarboxylic acid salt suitable for coloring dairy and beverage products.

NODIA

136. (A) I, II, and IV
Essential oils are prone to oxidation, and limonene can oxidize to form carveol, causing off-flavors. High temperatures accelerate volatile loss through packaging materials. However, flavor encapsulation in maltodextrin does not eliminate the need for a packaging barrier, as oxygen and moisture can still penetrate over time, making the third statement incorrect.

137. (D) 100 ppm (mg/kg)
Food safety regulations establish a maximum permitted concentration of 100 milligrams per kilogram, or 100 ppm, for the majority of approved synthetic food colors in general solid food products. This limit ensures that consumer exposure remains well below established toxicological safety thresholds, preventing health risks while providing sufficient coloring power for food manufacturers.

138. (A) Caramel Class IV is universally banned globally because of its severe acute toxicity.
Caramel Class IV is not universally banned, nor does it possess severe acute toxicity. It is globally

CHAPTER 07

Nutrition, RDA, Balanced Diet and Malnutrition

1. Which of the following best defines the term "Nutrition" in the context of food science and health?
(A) The mechanical and chemical breakdown of dietary compounds solely for systemic absorption within the digestive system.
(B) The agricultural and biotechnological modification of staple crops to optimize their baseline micronutrient levels.
(C) The clinical administration of synthetic chemical compounds and vitamin isolates to cure existing metabolic disorders.
(D) The study of dietary nutrients, their biochemical interactions, and their overall impact on human health and disease.

2. Consider the following statements regarding the functions of food:
I. Carbohydrates and fats are primarily categorized as energy-giving foods.
II. Proteins are essential for body-building, tissue repair, and the synthesis of enzymes.
III. Vitamins and minerals provide substantial caloric energy for metabolic processes.
IV. Protective foods are critical for immune function and regulation of metabolic pathways.
Which of the statements given above are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

3. Which of the following statements correctly describes the protective function of food?
(A) It involves the dietary intake of essential amino acids and protein substrates necessary for skeletal muscle growth.
(B) It involves the physiological roles of micronutrients and antioxidants in preventing systemic cellular damage.
(C) It relies on the steady intake of complex carbohydrates and starches to maintain stable systemic glucose levels.
(D) It is defined by the high energy density of lipids that physically shield internal organs from external trauma.

4. Consider the following statements:
Statement I: Essential amino acids cannot be synthesized by the human body in adequate amounts and must be obtained through the diet.
Statement II: All plant-based protein sources are considered complete proteins as they contain all essential amino acids in optimal proportions.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

5. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Foods rich in dietary fiber are considered functionally important despite not providing significant absorbable calories.
Reason (R): Dietary fiber delays gastric emptying, improves bowel movements, and aids in regulating blood sugar and cholesterol levels.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

6. A Food Safety Officer is inspecting a school feeding programme. The menu predominantly consists of polished white rice and clear lentil soup. To improve the "body-building" function of the meal for growing children, which of the following interventions should the officer recommend most strongly?
(A) Supplementing the meal with fortified refined sunflower oil to increase calories.
(B) Substituting the clear lentil soup with a

Downloaded from www.pdf.tube

148. (C) Utilizing copigmentation with natural flavonoids alongside keeping pH low and shielding UV light.
To stabilize natural anthocyanin extracts in sports drinks, formulators utilize copigmentation by adding natural flavonoids or organic acids, which associate with anthocyanins to form stable complexes. Maintaining a low pH stabilizes the red flavylium cation, while using packaging that shields against UV light prevents photo-oxidation, effectively extending color shelf life without synthetic additives.

149. (A) GMP rules - Dictates precise numerical limits in ppm for all natural color usage.
Good Manufacturing Practices guidelines do not dictate precise numerical limits in ppm for natural colors; instead, they allow manufacturers to use natural colorants at the minimum quantity required to achieve the desired effect. The other pairs correctly define regulatory standards, labeling requirements, and safety panels, making the natural color limit description incorrect.

150. (D) The beverage is non-compliant because MSG addition is prohibited in foods for young children.
Food safety regulations strictly prohibit the addition of monosodium glutamate to foods and beverages formulated specifically for infants and young children. This precaution protects their developing physiological systems from excessive glutamate exposure. Finding MSG in a child's beverage formulation constitutes a serious regulatory non-compliance, regardless of the other permitted ingredients present.

NODIA

15. What is the primary storage form of carbohydrates in the human body?
(A) Glycogen
(B) Amylose
(C) Cellulose
(D) Glucagon

16. Which of the following accurately defines "Dietary Reference Intakes" (DRIs)?
(A) A single reference value indicating the absolute minimum requirement of a nutrient to prevent clinical deficiency.
(B) The maximum amount of daily caloric intake allowed for preventing obesity in a population.
(C) A comprehensive set of reference values used to plan and assess nutrient intakes of healthy people.
(D) A legislative document mandating the fortification levels for commercial food products.

17. Consider the following statements regarding the classification of foods by origin:
I. Foods of plant origin generally lack Vitamin B12, unless fortified.
II. Foods of animal origin are typically rich sources of dietary fiber.
III. Heme iron, which is highly bioavailable, is found exclusively in animal-source foods.
IV. Phytochemicals are physiologically active compounds found primarily in animal tissues.
Which of the above statements are correct?
(A) I and III
(B) II and IV
(C) I, II, and III
(D) I, III, and IV

18. Which of the following statements about macronutrients is correct?
(A) Proteins yield approximately 9 kcal per gram of energy upon complete oxidative combustion in human cells.
(B) Fats are considered minor nutrients because they are required in much smaller daily quantities than vitamins.
(C) Carbohydrates are the main energy source utilized by the human brain under normal physiological conditions.
(D) Water is classified as an active energy-yielding macronutrient due to its fundamental role in cellular hydrolysis.

19. Consider the following statements:
Statement I: The Estimated Average Requirement (EAR) is the intake level for a nutrient at which the needs of 50% of the healthy population are met.
Statement II: The Recommended Dietary Allowance (RDA) is generally calculated as $EAR + 2SD$ (standard deviations) to cover the needs of 97-98% of the population.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

20. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Plant-based iron sources (non-heme iron) have a lower absorption rate compared to animal-based iron sources (heme iron).
Reason (R): Non-heme iron absorption is enhanced by the presence of phytates and tannins in the meal.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

21. A dietitian is calculating the Tolerable Upper Intake Level (UL) for a new nutrient supplement. The purpose of determining the UL is to:
(A) Establish the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects.
(B) Ensure the specific commercial supplement provides enough active ingredients to completely cure chronic disease.`
(C) Determine the exact minimum amount of the nutrient that exactly fifty percent of a healthy population requires.
(D) Set the baseline therapeutic intake levels for clinical patients suffering from severe malabsorption syndromes.

22. Which of the following correctly identifies an incorrect statement regarding a balanced diet?
(A) A balanced diet provides all essential nutrients in the correct proportions required by the body.
(B) A balanced diet allows for a small proportion of energy to be derived from free sugars and

Click Here to Buy book on Amazon

P. ICDS (Integrated Child Development Services)
Q. NIPI (National Iron Plus Initiative)
R. PM POSHAN (Mid-Day Meal)
S. Vitamin A Supplementation Program

List II: (Target Group/Objective)
I. School-going children (Class I to VIII)
II. Children under 6, pregnant & lactating mothers
III. Prevention of nutritional blindness in children 9-59 months
IV. Anemia prevention across life stages (infants to adults)

(A) P-II, Q-IV, R-I, S-III
(B) P-I, Q-IV, R-II, S-III
(C) P-II, Q-III, R-I, S-IV
(D) P-IV, Q-II, R-I, S-III

69. In an urban slum, poor sanitation and lack of safe drinking water lead to recurrent episodes of diarrhea in young children. This environmental failure initiates a cycle that directly causes which physiological effect?
(A) Intestinal villi blunting and enteric dysfunction, causing severe malabsorption and somatic wasting.
(B) Enhanced intestinal absorption of essential fat-soluble vitamins and dietary lipids in hepatocytes.
(C) Rapid increase in height-for-age due to continuous compensatory cellular and skeletal tissue growth.
(D) Systemic hypervitaminosis A arising directly from underlying chronic liver and metabolic dysfunction.

70. Which of the following pairs of assessment parameter and its purpose is correctly matched?
(A) Dietary Recall - To measure exact bone mineral density in study cohorts.
(B) Biochemical analysis - To estimate total household socioeconomic income.
(C) Clinical Examination - To detect visible signs like goitre or Bitot's spots.
(D) Anthropometry - To assess historical dietary diversity and meal frequencies.

71. Arrange the following steps of a community nutritional assessment and intervention program in a logical sequence.
1. Implementation of the specific nutritional intervention (e.g., fortification).
2. Assessment of community nutritional status using ABCD methods.
3. Monitoring and evaluating the impact of the intervention.
4. Identifying the specific nutritional deficiency prevalent in the target population.

(A) 2, 4, 1, 3
(B) 4, 2, 1, 3
(C) 2, 1, 4, 3
(D) 1, 2, 3, 4

72. All of the following are recognized strategies for the prevention and control of malnutrition EXCEPT:
(A) Implementing broad dietary diversification programs.
(B) Enforcing nation-wide food fortification mandates.
(C) Conducting community nutrition education sessions.
(D) Encouraging exclusive consumption of polished grains.

73. During a village health camp, a 45-year-old woman complains of chronic fatigue, breathlessness on exertion, and spoon-shaped nails (koilonychia). A dietary assessment reveals minimal intake of green leafy vegetables and animal products. Based on this case, what is the most appropriate initial intervention?
(A) Recommending immediate high-dose oral supplementation with Vitamin D.
(B) Prescribing oral iron and folic acid supplements alongside dietary counseling.
(C) Advising a strictly ketogenic dietary regimen to improve overall energy levels.
(D) Implementing mandatory daily high-dose therapeutic iodine supplementation.

74. What is the most appropriate primary objective of nutrition education in community settings?
(A) To strictly enforce a singular type of dietary regimen on all individuals regardless of their cultural background.
(B) To actively promote the market sales of commercially manufactured nutritional supplement pills and processed formulas.
(C) To empower individuals with knowledge to make healthy food choices using locally available, affordable resources.
(D) To clinically diagnose and medically treat severe metabolic and endocrine disorders within tertiary care hospitals.

NODIA

day to meet metabolic demands regardless of age or physical activity.
(C) A diet consisting entirely of organic, plant-based whole foods without the addition of any synthetic compounds.
(D) A diet in which carbohydrates, proteins, and fats each contribute an equal third of the total daily energy pool.

32. Consider the following statements regarding standard Indian dietary guidelines:
I. The reference body weight for an Indian adult woman has been updated to 55 kg.
II. The energy requirement calculations are now based on resting metabolic rate and physical activity ratio.
III. The RDA for calcium for adult men and women has been reduced to 600 mg/day.
IV. Carbohydrates should contribute 50-60% of total energy in a balanced diet.
Which of the statements given above are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

33. Which of the following statements correctly differentiates between EAR and RDA?
(A) EAR represents the Tolerable Upper Intake Level of a nutrient, whereas RDA is the baseline minimum human requirement.
(B) EAR is calculated based on controlled animal studies, whereas RDA is derived from population epidemiological data.
(C) EAR is only used for major macronutrients, whereas RDA applies exclusively to essential dietary micronutrients.
(D) EAR meets the needs of 50% of the healthy population, while RDA is designed to meet the needs of 97-98% of the population.

34. Consider the following statements:
Statement I: The Tolerable Upper Intake Level (UL) is a target intake intended to optimize health benefits beyond basic nutrition.
Statement II: Chronic intake of nutrients above the UL increases the potential risk of adverse health effects.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

35. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): The RDA for iron is significantly higher for women of reproductive age compared to adult men.
Reason (R): Women of reproductive age require additional iron to compensate for basal physiological losses and regular menstrual blood loss.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

36. A Food Safety Officer is evaluating a commercial nutritional beverage marketed for pregnant women in India. The label claims to meet 100% of the Recommended Dietary Allowance (RDA) for Calcium for pregnant women in India. What amount of calcium should a single daily serving provide to make this claim true?
(A) 600 mg
(B) 800 mg
(C) 1200 mg
(D) 1000 mg

NQDIA

37. Which of the following identifies an incorrect statement about food groups as used in diet planning?
(A) The "Fats and Sugars" group should form the largest portion of the food pyramid to ensure sufficient caloric intake.
(B) The "Cereals and Millets" group serves as the primary dietary source of energy and essential B-complex vitamins.
(C) The "Pulses and Legumes" group serves as the primary and major source of high-quality protein in vegetarian diets.
(D) The "Vegetables and Fruits" group provides key dietary fiber, essential vitamins, minerals, and phytonutrients.

38. Match the population group in List I with their specific nutritional priority in List II.
List I: (Population Group)
P. Infants (0-6 months)
Q. Pregnant women
R. Elderly individuals
S. Adolescents
List II: (Nutritional Priority)

needed to access a diverse and nutrient-rich diet.
(C) Environmental factors such as poor sanitation and lack of safe drinking water contribute directly to enteropathy and malnutrition.
(D) Social factors such as female literacy rates have no measurable impact on child nutrition indices.

53. Match the micronutrient deficiency disorder in List I with its primary clinical sign in List II.
List I: (Deficiency Disorder)
P. Xerophthalmia
Q. Scurvy
R. Rickets
S. Anaemia
List II: (Clinical Sign)
I. Bowed legs and widened epiphyses
II. Bitot's spots and corneal xerosis
III. Pallor of the conjunctiva and fatigue
IV. Spongy, bleeding gums and petechiae
(A) P-II, Q-IV, R-I, S-III
(B) P-IV, Q-II, R-III, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-IV, R-I, S-II

54. An acute lack of dietary Vitamin A combined with severe protein-energy malnutrition causes a failure in maintaining the integrity of epithelial tissues. What is the immediate, irreversible clinical effect on the eye if left untreated?
(A) Chronic open-angle glaucoma
(B) Accelerated cataract formation
(C) Keratomalacia leading to blindness
(D) Severe progressive high myopia

55. Which of the following pairs of nutritional assessment method and its example is correctly matched?
(A) Biochemical - Measurement of serum albumin levels
(B) Anthropometric - Conduct of 24-hour dietary recall
(C) Clinical - Weighing a young infant on a digital scale
(D) Dietary - Physical check for the presence of goitre

56. Based on nutritional concept application, if a community intervention provides iron-folic acid (IFA) tablets to adolescent girls, which specific type of malnutrition is being directly addressed?
(A) Severe Acute Malnutrition (SAM)
(B) Protein-Energy Malnutrition (PEM)
(C) Overnutrition of macro-nutrients
(D) Hidden Hunger or micronutrient deficiency

57. All of the following are biochemical methods used in the assessment of nutritional status, EXCEPT:
(A) Laboratory estimation of hemoglobin concentration in blood samples.
(B) Physical assessment of mid-upper arm circumference (MUAC) values.
(C) Chemical measurement of urinary iodine excretion rates in cohorts.
(D) Quantitative analysis of serum ferritin levels in clinical patients.

58. In designing a community nutrition intervention to tackle Vitamin A deficiency, which approach is considered the most cost-effective and immediate strategy for populations with difficult access to dietary diversity?
(A) Implementing advanced genetic engineering of all indigenous carbohydrate cereal crops.
(B) Providing free prescription eyeglasses to all children presenting with poor vision.
(C) Administering high-dose Vitamin A supplements biannually to vulnerable preschool children.
(D) Establishing high-technology indoor hydroponic farms within local community centers.

59. What is the most appropriate interpretation of "Stunting" in children under five years of age?
(A) A condition reflecting acute weight loss due to a recent bout of severe illness, measured as low weight-for-height.
(B) A congenital genetic disorder that prevents children from growing past a certain height regardless of dietary intake.
(C) A pathological metabolic condition caused solely by the heavy overconsumption of simple calories in early infancy.
(D) A state of chronic undernutrition representing failure to achieve expected linear growth, measured as low height-for-age.

60. Which national survey in India provides comprehensive data on the prevalence of malnutrition, including stunting, wasting, and anemia across different states and demographics?
(A) National Family Health Survey (NFHS)
(B) Sample Registration System (SRS)

Downloaded from www.pdf.tube

of physical satiety reported by study participants after consuming the nutrient.
(D) The absolute maximum amount of the nutrient that can be safely consumed daily without causing gastrointestinal distress.

46. Which of the following best defines "Malnutrition"?
(A) A pathological state exclusively resulting from a chronic, severe deficit in daily dietary energy consumption.
(B) An abnormal physiological state caused by deficient, excessive, or imbalanced intake of essential nutrients.
(C) A systemic clinical condition caused solely by the highly excessive consumption of refined sugars and carbohydrates.
(D) The minor, transient physiological stress experienced by the metabolic system during structured intermittent fasting.

47. Consider the following statements about the double burden of malnutrition:
I. It refers to the coexistence of undernutrition and overnutrition within the same population, community, or even household.
II. It is entirely eliminated once a developing country achieves high-income status.
III. It can manifest as a child being stunted while the mother is overweight.
IV. The consumption of cheap, ultra-processed, calorie-dense but nutrient-poor foods is a major driver of this phenomenon.
Which of the statements given above are correct?
(A) I, II, and III
(B) I, II, and IV
(C) I, III, and IV
(D) II, III, and IV

48. Which of the following statements correctly identifies a key difference between Kwashiorkor and Marasmus?
(A) Kwashiorkor is characterized by severe wasting of muscle and subcutaneous fat with absolutely no edema, whereas Marasmus features prominent bilateral pitting edema.
(B) Marasmus typically presents with characteristic "flaky paint" dermatosis and an enlarged fatty liver, whereas Kwashiorkor lacks these specific clinical findings.
(C) Kwashiorkor results from a severe dietary protein deficit despite marginal calorie intake, while Marasmus is a severe deficiency of both calories and protein.
(D) Kwashiorkor affects geriatric adults predominantly in rural areas, whereas Marasmus is exclusively seen in healthy, breastfed infants under six months of age.

49. Consider the following statements:
Statement I: Undernutrition during the critical first 1,000 days of life (from conception to age two) can lead to irreversible stunting and cognitive deficits.
Statement II: Catch-up growth in adolescence completely reverses all neurological damage caused by severe early childhood stunting.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

50. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Overnutrition leading to obesity is now recognized as a form of malnutrition.
Reason (R): Obesity is characterized by an imbalance of nutrients, specifically an excessive intake of energy relative to expenditure, often accompanied by micronutrient deficiencies.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

51. A two-year-old child from an economically disadvantaged family presents at a clinic with severe muscle wasting, absent subcutaneous fat, a "wizened" old-man facial appearance, but no edema. The child is alert and extremely hungry. Based on clinical assessment, what is the most likely diagnosis?
(A) Kwashiorkor
(B) Marasmus
(C) Scurvy
(D) Rickets

52. Which of the following statements about the causes of malnutrition is incorrect?
(A) Biological factors include recurrent infectious diseases like diarrhea, which worsen nutrient malabsorption.
(B) Economic factors limit the purchasing power

(C) RDA values cover the nutrient requirements of only 50% of the healthy population.
(D) RDA includes a margin of safety to account for individual variations in absorption and metabolism.

83. Match the food group in List I with its major nutritional contribution in List II.
List I: (Food Group)
P. Fats and Oils
Q. Green Leafy Vegetables
R. Cereals and Millets
S. Meat and Poultry
List II: (Nutritional Contribution)
I. High-quality protein and highly bioavailable iron
II. Concentrated source of energy and essential fatty acids
III. Major source of energy and B-vitamins
IV. Rich source of folic acid, calcium, and iron
(A) P-II, Q-IV, R-III, S-I
(B) P-III, Q-IV, R-II, S-I
(C) P-II, Q-I, R-III, S-IV
(D) P-IV, Q-II, R-III, S-I

84. A severe deficiency of Vitamin D in children leads to impaired mineralization of growing bones. What is the direct physical consequence of this biochemical failure?
(A) Excessive mineralized bone density leading directly to pituitary gigantism.
(B) Immediate calcification of joint cartilage, leading to severe chronic arthritis.
(C) Complete and permanent cessation of bone remodeling, causing early osteoporosis.
(D) Softening and weakening of bones, leading to skeletal deformities such as rickets.

85. Which of the following pairs of nutrient and its specific function is correctly matched?
(A) Fluoride - Prevention of dental caries
(B) Zinc - Oxygen transport in blood
(C) Sodium - Formation of the structural matrix of bones
(D) Vitamin K - Regulation of visual cycle in the retina

86. When assessing the dietary intake of a population using a 24-hour recall method, a nutritionist must rely on the memory of the participants. This reliance introduces an inherent flaw into the data collection. What is this concept known as in dietary assessment?
(A) Biochemical interference
(B) Anthropometric error
(C) Recall bias
(D) Clinical manifestation

87. All of the following are potential adverse effects of overnutrition (excessive caloric intake) EXCEPT:
(A) Kwashiorkor
(B) Type 2 Diabetes Mellitus
(C) Hypertension
(D) Cardiovascular disease

88. A community assessment reveals a high incidence of neural tube defects in newborns. Investigations show the staple diet is heavily refined and devoid of fortification. What targeted intervention should be immediately implemented for women of childbearing age?
(A) Iodine supplementation
(B) Vitamin A supplementation
(C) High-protein supplementary food
(D) Folic acid supplementation

89. What is the most appropriate definition of "Bioavailability" in the context of nutrition?
(A) The total concentration of a nutrient present in a raw food item prior to any thermal cooking.
(B) The proportion of an ingested nutrient that is absorbed and utilized by the body for bodily functions.
(C) The environmental rate at which a raw food item degrades under standard atmospheric exposure.
(D) The absolute economic cost required to procure certified biologically organic foods on the market.

90. Which of the following defines the "Tolerable Upper Intake Level" (UL) in the DRI framework?
(A) The absolute maximum weight and volume of food an individual can physically consume within a single day.
(B) The mandatory minimum level of micronutrient fortification legally required in staple products by law.
(C) The highest daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals.
(D) The average daily nutritional intake level that successfully meets the requirements of half of a group.

Click Here to Buy book on Amazon

(C) National Sample Survey Office (NSSO) Employment Survey
(D) Census of India

61. Which of the following formulas is used to calculate the Body Mass Index (BMI), a common anthropometric measurement for adults?
(A) Weight (kg) /Height (cm)
(B) Weight (kg) /Height^2 (m^2)
(C) Height (m) /Weight^2 (kg^2)
(D) Weight (lbs) /Height (inches)

62. Consider the following statements about the causes of anemia in India:
I. Iron deficiency is the most common cause of anemia.
II. Folate and Vitamin B12 deficiencies do not contribute to the anemia burden.
III. Hookworm infestations can exacerbate iron deficiency anemia by causing chronic intestinal blood loss.
IV. Malaria is an environmental/biological factor that can cause hemolytic anemia.
Which of the above statements are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

63. Which of the following correctly identifies the term for the form of severe acute malnutrition (SAM) characterized by bilateral pitting edema?
(A) Kwashiorkor
(B) Nutritional dwarfism
(C) Marasmus
(D) Cachexia

64. Consider the following statements:
Statement I: The Mid-Day Meal Scheme (now PM POSHAN) is a dietary intervention aimed primarily at improving the nutritional status of pregnant women.
Statement II: Food fortification is a strategy used to add essential trace elements and vitamins to staple foods to prevent micronutrient deficiencies in the general population.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

65. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Exclusive breastfeeding for the first six months of life is a critical intervention to prevent malnutrition.
Reason (R): Breastmilk provides optimal nutrients, protects against gastrointestinal infections, and promotes a healthy gut microbiome in infants.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

66. A public health nutritionist uses MUAC (Mid-Upper Arm Circumference) tapes in a rural village. A child's measurement falls in the red zone (<115 mm). What is the competency-based immediate action required?
(A) Prescribe a high-protein adult diet and advise a follow-up consultation in exactly six months.
(B) Advise the mother to reduce the child's daily fluid intake to prevent any potential pedal edema.
(C) Diagnose the child with Severe Acute Malnutrition (SAM) and refer immediately to an NRC facility.
(D) Conclude that the child is clinically healthy as long as their baseline height-for-age is normal.

NODIA

67. Which of the following statements about the prevalence of malnutrition in India is incorrect?
(A) The prevalence of anemia among women of reproductive age remains a significant public health challenge.
(B) Stunting has been completely eradicated in all urban centers across the country.
(C) The coexistence of overweight/obesity and undernutrition highlights the double burden of malnutrition.
(D) Wasting in children under five is still highly prevalent and fluctuates with seasonal food availability and disease outbreaks.

68. Match the community nutrition intervention programme in List I with its primary target group/objective in List II.
List I: (Programme)

I. Increased need for calcium and vitamin D to prevent osteoporosis, alongside easy digestibility.
II. Rapid growth spurts requiring high calorie and protein density.
III. Exclusive dependence on breastmilk for optimal nutrition and immunity.
IV. Elevated requirement for folic acid and iron for fetal development and maternal blood volume expansion.
(A) P-III, Q-IV, R-I, S-II
(B) P-IV, Q-III, R-II, S-I
(C) P-III, Q-I, R-IV, S-II
(D) P-II, Q-IV, R-I, S-III

39. Prolonged consumption of polished white rice as the sole staple food, coupled with a lack of protective foods, creates an extreme deficiency of thiamine. This nutritional deficit directly leads to which physiological effect?
(A) Accumulation of pyruvic acid and lactic acid in tissues, causing peripheral neuropathy and cardiac failure.
(B) Impaired systemic collagen synthesis, which weakens blood capillaries and leads to severe bleeding gums.
(C) Structural inability of the retina to synthesize rhodopsin, directly resulting in severe night blindness.
(D) Defective mineralization of bone osteoid tissue, leading to structural softening of the skeletal system.

40. Which of the following pairs is correctly matched regarding the standard physical activity classification for adults?
(A) Sedentary worker - Construction laborer
(B) Moderate worker - Software engineer
(C) Sedentary worker - Agricultural laborer
(D) Heavy worker - Stone cutter

41. Arrange the following food groups in the order of their recommended volumetric contribution to a standard balanced dietary plate (from largest proportion to smallest).
1. Cereals and Millets
2. Vegetables and Fruits
3. Fats and Oils
4. Pulses and Legumes
(A) 1, 2, 4, 3
(B) 2, 1, 4, 3
(C) 1, 4, 2, 3
(D) 2, 4, 1, 3

42. All of the following are primary factors necessitating a change in the RDA for elderly individuals EXCEPT:
(A) A decrease in basal metabolic rate (BMR).
(B) Reduced physical activity levels.
(C) An increased demand for calories to support hyperactive organ function.
(D) Age-related changes in the absorption and utilization of certain nutrients like Vitamin B12.

43. An endurance athlete is preparing for a marathon. To optimize muscle glycogen stores before the event, which dietary strategy is most scientifically sound?
(A) Consuming a strict low-carbohydrate diet consisting of 80% fat and 20% protein in the week prior to the race.
(B) Fasting completely for 24 hours prior to the start of the race to stimulate maximum endogenous lipolysis.
(C) Consuming only pure glucose syrup on the entire day before the event to maximize baseline blood sugar levels.
(D) Implementing a "carbohydrate loading" protocol, tapering training while increasing complex carbohydrate intake.

44. Which of the following is the best description of "Empty Calories" in nutrition?
(A) Foods that possess a high caloric value but little to no essential vitamins, minerals, or protein.
(B) Foods that pass through the human gastrointestinal tract without undergoing any systemic absorption.
(C) Beverages that have absolutely zero calories but remain highly rich in essential dietary micronutrients.
(D) Non-digestible dietary fiber sources that do not contribute any usable energy to the somatic pool.

45. What is the fundamental physiological basis for establishing the Estimated Average Requirement (EAR) for a nutrient?
(A) The total therapeutic intake level required to completely cure specific chronic metabolic diseases in clinical patients.
(B) A specific, measurable criterion of nutritional adequacy, such as maintaining a certain enzyme or blood concentration.
(C) The subjective, self-reported feeling

Downloaded from www.pdf.tube

75. The term "Hidden Hunger" refers specifically to which type of nutritional issue?
(A) Severe acute somatic wasting where the biological sensation of hunger is masked by bilateral pedal edema.
(B) The persistent psychological desire to eat despite already consuming adequate baseline daily calories.
(C) Chronic nocturnal night eating syndrome accompanied by sleep disturbances and high morning anorexia.
(D) Micronutrient deficiencies occurring without obvious clinical signs of generalized undernutrition.

76. The disease "Pellagra" is classically associated with the "4 Ds" (Dermatitis, Diarrhea, Dementia, and Death). It is caused by a deficiency of which nutrient?
(A) Niacin (Vitamin B3)
(B) Thiamine (Vitamin B1)
(C) Riboflavin (Vitamin B2)
(D) Pyridoxine (Vitamin B6)

77. Consider the following statements regarding iodine deficiency:
I. Iodine is essential for the synthesis of thyroid hormones, thyroxine (T4) and triiodothyronine (T3).
II. Iodine deficiency during pregnancy can result in cretinism in the newborn.
III. Goitre is a clinical manifestation of iodine excess, not deficiency.
IV. Universal salt iodization is a globally recommended strategy to combat iodine deficiency disorders (IDD).
Which of the statements given above are correct?
(A) I, II, and III
(B) I, II, and IV
(C) I, III, and IV
(D) II, III, and IV

78. Which of the following statements correctly describes the nutritional requirement of athletes compared to sedentary individuals?
(A) Athletes require significantly lower carbohydrate intake as their bodies switch exclusively to protein burning.
(B) Athletes require higher total energy intake, sufficient protein for muscle repair, and adequate hydration to maintain performance.
(C) Athletes need massive doses of isolated vitamin supplements because micronutrients are rapidly destroyed in muscles during exercise.
(D) Athletes should strictly avoid all dietary fats to prevent cardiovascular strain during heavy exertion.

79. Consider the following statements:
Statement I: Anthropometric measurements provide immediate real-time data on a patient's exact circulating vitamin levels.
Statement II: Biochemical assessments, such as blood and urine tests, are required to detect subclinical nutrient deficiencies before visible symptoms appear.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

80. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Mandatory fortification of edible oil and milk with Vitamins A and D has been initiated by FSSAI in India.
Reason (R): Vitamins A and D are water-soluble and easily degrade during the refining and pasteurization processes, requiring replenishment.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

81. An elderly individual is suffering from atrophic gastritis, which reduces the secretion of gastric acid and intrinsic factor. This physiological change most significantly impairs the absorption of which essential nutrient?
(A) Vitamin C
(B) Carbohydrates
(C) Dietary fiber
(D) Vitamin B12

82. Which of the following statements about the Recommended Dietary Allowance (RDA) is incorrect?
(A) RDA varies based on age, sex, and physiological status (e.g., pregnancy).
(B) RDA is intended to serve as a goal for daily intake by individuals.

NODIA

saturated fats.
(C) A balanced diet for an adult must consist of at least 70% of total calories from pure dietary fats.
(D) A balanced diet incorporates a variety of food items from different food groups.

23. Match the Dietary Reference Intake (DRI) term in List I with its description in List II.
List I: (DRI Term)
P. RDA
Q. EAR
R. AI
S. UL
List II: (Description)
I. Used when sufficient scientific evidence is not available to calculate an EAR.
II. The intake level sufficient to meet the nutrient requirement of 97-98% of healthy individuals.
III. The highest average daily intake likely to pose no risk of adverse health effects.
IV. The nutrient intake value estimated to meet the requirement of half the healthy individuals in a group.
(A) P-II, Q-IV, R-I, S-III
(B) P-IV, Q-II, R-III, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-IV, R-I, S-II

24. Severe restriction of carbohydrates in the diet forces the liver to synthesize an alternative energy source for the brain. What is the physiological effect of this dietary shift?
(A) Enhanced liver synthesis of extremely low-density lipoproteins (VLDL).
(B) Rapid systemic depletion of essential amino acids in skeletal muscle.
(C) Complete metabolic shutdown of gluconeogenesis in the renal cortex.
(D) Increased production of ketone bodies leading to nutritional ketosis.

25. Which of the following pairs of nutrient and its major dietary source is incorrectly matched?
(A) Omega-3 fatty acids - Fresh marine fatty fish
(B) Vitamin B12 - Fermented organic plant foods
(C) Lycopene - Ripe agricultural tomatoes
(D) Calcium - Ragi grain (Finger millet)

26. An individual wants to maximize the bioavailability of iron from a spinach and lentil meal. Which of the following concept applications is most effective?
(A) Consuming the meal with a cup of strong black tea.
(B) Taking a calcium carbonate supplement simultaneously with the meal.
(C) Adding a squeeze of fresh lemon juice (Vitamin C) to the meal.
(D) Boiling the spinach for an extended period and discarding the water.

27. All of the following are components of the Dietary Reference Intakes (DRI) framework, EXCEPT:
(A) Estimated Average Requirement (EAR)
(B) Recommended Dietary Allowance (RDA)
(C) Tolerable Upper Intake Level (UL)
(D) Maximum Residue Limit (MRL)

28. A pregnant woman in her second trimester has a significantly increased requirement for folate. If she consumes a strictly processed-food diet devoid of leafy greens or fortified foods, she is at highest risk for which of the following fetal outcomes?
(A) Neural tube defects
(B) Macrosomia
(C) Fetal alcohol syndrome
(D) Congenital hypothyroidism

29. What is the standard definition of the "Reference Indian Man" in nutritional guidelines?
(A) A 60 kg man, between 18-29 years of age, engaged in moderate daily work.
(B) A 65 kg man, between 19-39 years of age, engaged in sedentary daily work.
(C) A 70 kg man, between 20-40 years of age, engaged in heavy muscular work.
(D) A 55 kg man, between 25-45 years of age, engaged in sedentary daily work.

30. What is the Recommended Dietary Allowance (RDA) for protein for a healthy Indian adult?
(A) 1.0 g/kg body weight/day
(B) 0.83 g/kg body weight/day
(C) 1.2 g/kg body weight/day
(D) 0.6 g/kg body weight/day

31. Which of the following best defines a "Balanced Diet" in the context of human nutrition?
(A) A diet supplying all essential nutrients to maintain health, plus a small buffer for short periods of leanness.
(B) A diet that provides exactly 2000 kcal per

Click Here to Buy book on Amazon

91. Consider the following statements regarding malnutrition assessment:
I. BMI-for-age is a critical parameter for identifying overweight and obesity in children and adolescents.
II. Waist-to-hip ratio is exclusively used to assess clinical vitamin deficiencies.
III. Weight-for-height (Z-score <-2) is an indicator of wasting.
IV. Edema of both feet is a definitive clinical sign of severe acute malnutrition, regardless of weight.
Which of the statements given above are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

92. Which of the following statements correctly differentiates between undernutrition and overnutrition?
(A) Undernutrition results from inadequate intake of nutrients, whereas overnutrition is caused by excessive intake of dietary energy.
(B) Undernutrition involves an excess of essential micro-nutrients, while overnutrition involves a systemic deficit of macro-nutrients.
(C) Undernutrition only affects pediatric children in developing nations, whereas overnutrition exclusively affects wealthy adult populations.
(D) Undernutrition can be cured rapidly with gastrointestinal surgery, whereas overnutrition requires strictly dietary solutions.

93. Consider the following statements:
Statement I: Rickets is a childhood disease caused primarily by a deficiency of Vitamin D, calcium, or phosphate.
Statement II: Osteomalacia is the adult equivalent of rickets, characterized by softening of the bones.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

94. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): The promotion of kitchen gardens (nutri-gardens) is an effective strategy for preventing micronutrient malnutrition.
Reason (R): Kitchen gardens provide households with direct access to a diverse range of fresh vegetables and fruits rich in vitamins and minerals.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

95. A factory worker engages in heavy manual labor for 8 hours a day. He consumes a diet sufficient in calories but entirely lacking in fresh fruits and vegetables. After several months, he complains of bleeding gums, joint pain, and delayed wound healing. What is the most appropriate dietary recommendation to reverse this condition?
(A) Introduce amla, citrus fruits, and guava into his daily diet.
(B) Increase intake of polished rice to boost energy levels.
(C) Recommend immediate supplementation with high-dose Vitamin B12.
(D) Advise him to consume more dairy products for calcium.

96. Which of the following statements about the causes of malnutrition is incorrect?
(A) Maternal illiteracy is a significant social determinant of child malnutrition.
(B) Frequent gastrointestinal infections, such as those caused by unsafe water, decrease nutrient absorption and cause malnutrition.
(C) Economic prosperity of a household guarantees the complete absence of nutritional deficiencies among its members.
(D) Cultural beliefs and food taboos can restrict the intake of essential nutrients during pregnancy.

97. Match the term related to malnutrition in List I with its description in List II.
List I: (Term)
P. Wasting
Q. Stunting
R. Underweight
S. Overweight
List II: (Description)
I. Low weight-for-age, a composite index of both acute and chronic malnutrition
II. High weight-for-height, indicating excessive

Downloaded from www.pdf.tube

142. Arrange the following nutritional assessment methods in order from the least invasive (most commonly used for large-scale rapid community screening) to the most invasive and precise (used for clinical diagnosis).
1. Biochemical blood analysis
2. Measuring mid-upper arm circumference (MUAC)
3. Detailed 7-day weighed dietary record
4. Clinical physical examination for signs of deficiency

(A) 2, 4, 3, 1
(B) 2, 3, 4, 1
(C) 4, 2, 1, 3
(D) 3, 2, 4, 1

143. All of the following are consequences of iodine deficiency disorders (IDD) EXCEPT:
(A) Hyperthyroidism (Graves' disease)
(B) Systemic clinical hypothyroidism
(C) Hypertrophic thyroid goitre
(D) Impaired cognitive development

144. An agricultural community shifts from growing diverse traditional millets and pulses to cultivating only a single cash crop (sugarcane). The income increases slightly, but dietary diversity plummets, and children begin showing signs of anemia and stunting. What is the most appropriate concept describing this phenomenon?
(A) Standard nutrition transition leading directly to pure macronutrient overnutrition and obesity.
(B) Rapid genetic and physiological adaptation of the local population to a high-sucrose diet.
(C) Economic growth failing to translate into improved nutritional status due to loss of dietary diversity.
(D) Complete successful elimination of the double burden of malnutrition within the rural community.

145. What is the most appropriate method for a Food Safety Officer to verify if a commercially sold salt brand conforms to the public health requirement for preventing iodine deficiency?
(A) Tasting the commercial salt sample directly to evaluate the level of bitterness and metallic flavor.
(B) Weighing the physical packaging bags on calibrated digital scales to ensure exact net weight accuracy.
(C) Dissolving the salt crystals in distilled water to check exclusively for any insoluble chemical impurities.
(D) Checking for the presence of the +F logo and conducting chemical analysis for iodine content in ppm.

NODIA

146. Which of the following essential amino acids is a precursor for the synthesis of the neurotransmitter serotonin and the vitamin niacin?
(A) Leucine
(B) Methionine
(C) Tryptophan
(D) Phenylalanine

147. Consider the following statements about essential and non-essential nutrients:
I. Essential nutrients cannot be synthesized by the body in adequate amounts.
II. Non-essential nutrients are not required by the body for metabolic functions.
III. Vitamin C is an essential nutrient for humans.
IV. Cholesterol is a non-essential nutrient because the liver synthesizes it.

Which of the statements given above are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

148. Which of the following statements about macronutrient digestion is incorrect?
(A) Carbohydrate digestion begins immediately in the oral cavity via the secretion of salivary amylase enzymes.
(B) Protein digestion primarily occurs in the stomach via pepsin and continues directly in the small intestine.
(C) Fat digestion is heavily reliant on hepatic bile salts emulsifying dietary lipids in the small intestinal lumen.
(D) All dietary fiber is completely broken down into glucose by human digestive enzymes in the large intestine.

149. Consider the following statements:
Statement I: Scurvy is characterized by poor wound healing, bleeding gums, and petechial hemorrhages.
Statement II: Ascorbic acid is a required cofactor for the hydroxylation of proline and lysine in the synthesis of mature collagen.

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

proteins of the organism's body.
II. Net Protein Utilization (NPU) is the ratio of amino acid converted to proteins to the ratio of amino acids supplied.
III. Cereal proteins are typically deficient in lysine.
IV. Legume proteins are typically deficient in methionine.
Which of the statements given above are correct?
(A) I and II only
(B) III and IV only
(C) I, III, and IV only
(D) I, II, III, and IV

106. Which of the following accurately describes a "Reference Woman" under standard Indian nutritional guidelines?
(A) Age 18-25 years, weighing 50 kg, healthy, and actively engaging in heavy physical labor.
(B) Age 30-45 years, weighing 60 kg, healthy, currently pregnant in her second trimester.
(C) Age 20-39 years, weighing 55 kg, healthy, non-pregnant, and non-lactating.
(D) Age 19-39 years, weighing 65 kg, healthy, and actively engaged in moderate daily work.

107. Consider the following statements:
Statement I: The primary goal of universal salt iodization is to prevent anemia in pregnant women.
Statement II: Iodine is critical for optimal brain development in the fetus and young children.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

108. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Undernourished pregnant women are more likely to have a low birth weight (LBW) infant, which can perpetuate malnutrition across generations.
Reason (R): Adequate maternal nutrition before and during pregnancy is essential for supporting optimal fetal growth and development.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

109. A dietitian must formulate a highly caloric and protein-dense therapeutic food for a child suffering from Severe Acute Malnutrition (SAM). Which of the following ingredients would be most appropriate as the primary base for this ready-to-use therapeutic food (RUTF)?
(A) Whole starch-rich boiled white potatoes
(B) Skim milk powder and lipid-dense peanut paste
(C) Clarified and pasteurized sweet apple juice
(D) Refined wheat flour mixed with warm water

110. Which of the following statements regarding the nutritional requirements of pregnant women is incorrect?
(A) Total energy requirements increase significantly during the metabolic shifts of the second and third trimesters.
(B) The iron requirement during pregnancy can be entirely met through a normal vegetarian diet without any supplements.
(C) Daily protein requirements are significantly increased to support maternal tissue synthesis and placental growth.
(D) Adequate folic acid intake is highly critical in the periconceptional period to prevent congenital neural tube defects.

111. Match the standard dietary guideline concept in List I with its description in List II.
List I: (Dietary Guideline Concept)
P. Eat a variety of foods
Q. Ensure provision of extra food
R. Restrict intake of salt
S. Drink plenty of water
List II: (Description)
I. Essential to prevent dehydration and maintain kidney function
II. Necessary for pregnant and lactating women
III. Prevents hypertension and associated cardiovascular diseases
IV. Ensures an adequate supply of all essential macro and micronutrients
(A) P-IV, Q-II, R-III, S-I
(B) P-II, Q-IV, R-I, S-III
(C) P-IV, Q-I, R-III, S-II
(D) P-III, Q-II, R-IV, S-I

112. The consumption of raw egg whites over a prolonged period binds biotin in the gastrointestinal tract due to the presence of

Click Here to Buy book on Amazon

ANSWERS

1. (D) The study of dietary nutrients, their biochemical interactions, and their overall impact on human health and disease.
Nutrition is the science that examines the relationship between diet, health, and disease. It encompasses the physiological processes of ingestion, digestion, absorption, and metabolism of nutrients. Understanding these biochemical interactions helps optimize human health, prevent chronic illnesses, and guide public health guidelines regarding daily food intake patterns in diverse populations.

2. (B) I, II, and IV
Carbohydrates and lipids serve as the primary sources of physiological energy. Proteins are structurally essential for tissue synthesis, cellular repair, and enzymatic activities. Protective foods, which are rich in vitamins and minerals, regulate metabolic pathways and support immune function. However, micronutrients do not yield substantial direct caloric energy for metabolic processes.

3. (B) It involves the physiological roles of micronutrients and antioxidants in preventing systemic cellular damage.
The protective function of food is characterized by the action of essential vitamins, minerals, and antioxidant compounds. These micronutrients defend the human body against cellular damage, neutralize free radicals, and support immune responses. By maintaining physiological homeostasis, protective foods mitigate the risk of infectious diseases and chronic metabolic disorders without acting as primary energy sources.

4. (C) Statement I is true but Statement II is false.
Essential amino acids cannot be synthesized endogenously by the human body and must be supplied through dietary sources. Conversely, most plant-based proteins are incomplete because they lack one or more essential amino acids in sufficient quantities. Soybeans and quinoa are rare exceptions, but generally, plant foods must be combined to achieve a complete amino acid profile.

5. (A) Both A and R are true and R is the correct explanation of A.
Dietary fiber consists of non-digestible plant carbohydrates that do not yield significant calories. Despite this, it remains physiologically critical for human health. Fiber adds bulk to stool, promotes regular peristalsis, and delays gastric emptying. This mechanism slows glucose absorption, improves glycemic control, and binds bile acids to effectively reduce systemic cholesterol levels.

6. (C) Introducing boiled eggs or a thick, protein-dense legume preparation to the meal.
Body-building functions of food rely on high-quality proteins that provide essential amino acids for growth and tissue synthesis. Polished rice and clear lentil soup are deficient in lysinal and sulfur-containing amino acids. Introducing eggs or thick legume preparations delivers complete protein profiles, optimizing the anabolic pathways necessary for physical development in growing school children.

7. (A) Green leafy vegetables are primarily energy-yielding foods.
Green leafy vegetables are characterized by low caloric density and high micronutrient content, classifying them as protective foods rather than energy-yielding foods. Energy-yielding foods are dominated by carbohydrates and lipids, such as cereals, millets, and fats. Leafy greens primarily provide essential vitamins, minerals, and dietary fiber that support metabolic processes and cellular protection.

8. (A) P-II, Q-IV, R-I, S-III
Specific nutrients are linked to distinct dietary sources. Citrus fruits serve as rich sources of ascorbic acid, which is vital for immune function. Heme iron, highly bioavailable for red blood cell synthesis, is found in red meat. Dairy products are primary sources of calcium, while iodized salt prevents thyroid deficiency by delivering adequate iodine.

NODIA

120. Which of the following statements accurately reflects the concept of "Mutual Supplementation" in a vegetarian diet?
(A) Eating two highly processed chemical foods simultaneously to completely cancel out their negative toxic effects.
(B) Taking a synthetic concentrated multivitamin pharmaceutical pill alongside every single daily cooked meal.
(C) Eating highly massive quantities of a single plant source to easily satisfy the daily RDA values for protein.
(D) Combining cereals (low lysine) and pulses (low methionine) in a meal to provide a complete amino acid profile.

121. Consider the following statements:
Statement I: Anthropometric measurements are entirely independent of an individual's age and sex.
Statement II: Age and sex must be factored in when using growth charts and calculating Z-scores for accurate nutritional assessment.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

122. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): The elderly population is highly susceptible to malnutrition despite having lower energy requirements.
Reason (R): Ageing is associated with reduced appetite, poor dentition, impaired digestion and absorption, and a higher prevalence of chronic diseases.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

123. A 10-year-old boy consumes a diet that is highly caloric, consisting mainly of deep-fried snacks, sugary beverages, and refined carbohydrates, but completely lacks fresh vegetables, fruits, and quality protein. He is significantly overweight for his age. What specific state of malnutrition is he currently manifesting?
(A) Chronic childhood stunting representing long-term structural restriction of linear skeletal growth.
(B) Severe Acute Malnutrition (SAM) presenting with extreme muscle wasting and bilateral pitting edema.
(C) Severe childhood marasmus characterized by complete loss of subcutaneous adipose and muscle tissues.
(D) Double burden of malnutrition (overnutrition of calories paired with undernutrition of micronutrients).

124. Which of the following statements regarding the physiological effects of dehydration is incorrect?
(A) Dehydration enhances the physical performance and endurance of athletes by reducing body weight.
(B) Dehydration impairs systemic thermoregulation, increasing the risk of heatstroke during exercise.
(C) Severe dehydration decreases total circulating blood volume, leading directly to cardiovascular strain.
(D) Chronic mild dehydration can significantly increase the clinical risk of developing renal urolithiasis.

125. Match the assessment technique in List I with the specific tool/instrument used in List II.
List I: (Assessment Technique)
P. Anthropometry
Q. Dietary Assessment
R. Clinical Assessment
S. Biochemical Assessment
List II: (Tool/Instrument)
I. Food frequency questionnaire
II. Stadiometer
III. Spectrophotometer (for serum analysis)
IV. Physical examination of conjunctiva
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-IV, R-I, S-III
(D) P-IV, Q-I, R-II, S-III

126. A lack of intrinsic factor secretion in the stomach leads to the inability to absorb Vitamin B12 in the terminal ileum. This pathophysiological defect causes which specific condition?
(A) Iron-deficiency anemia
(B) Pernicious anemia
(C) Hemolytic anemia
(D) Sickle cell anemia

Downloaded from www.pdf.tube

127. Which of the following pairs is correctly matched regarding dietary fats?
(A) Polyunsaturated Fatty Acids (PUFA) - Sunflower oil
(B) Saturated Fatty Acids (SFA) - Cold-pressed olive oil
(C) Monounsaturated Fatty Acids (MUFA) - Standard cow butter
(D) Trans Fatty Acids - Freshly harvested organic coconut

128. In a clinical trial, participants are given a daily supplement of a specific nutrient to see if it reduces the incidence of common colds. What type of application concept in nutritional research does this represent?
(A) Cross-sectional observational epidemiological survey
(B) Retrospective longitudinal cohort study of patients
(C) Clinical intervention study (Randomized Controlled Trial)
(D) Systematic long-term community anthropometric surveillance

129. All of the following are considered essential fatty acids for humans EXCEPT:
(A) Linoleic acid
(B) Alpha-linolenic acid
(C) Arachidonic acid (conditionally essential)
(D) Stearic acid

130. A village has reported a high incidence of night blindness among children under 5 years of age. A public health officer plans an intervention. Which of the following is the most appropriate long-term sustainable strategy to eliminate this problem?
(A) Establishing a continuous daily supply of synthetic Vitamin A capsules via imported medical aid.
(B) Mandating the exclusive consumption of purely carnivorous animal diets for all local children.
(C) Promoting the cultivation and consumption of local dark green leafy vegetables and yellow fruits.
(D) Distributing free clinical prescription eyeglasses to all children presenting with poor vision.

131. What is the most appropriate definition of the term "Nutrient Density"?
(A) The mathematical ratio of the physical weight of a raw food item divided directly by its volume.
(B) The ratio of essential nutrients provided by a food relative to its total baseline caloric content.
(C) The total absolute amount of saturated fat and chemical lipid compounds present in a single food item.
(D) The physical thickness, density, and kinematic viscosity of a liquid or semi-solid food beverage.

NODIA

132. Which of the following minerals is universally recognized as the central atom in the hemoglobin molecule, essential for oxygen transport?
(A) Magnesium
(B) Calcium
(C) Copper
(D) Iron

133. Consider the following statements regarding the nutritional properties of milk:
I. Milk is considered a good source of high biological value protein and calcium.
II. Milk is naturally a rich source of Vitamin C and Iron.
III. Pasteurization of milk primarily serves to kill pathogenic microorganisms, making it safe for consumption.
IV. Fermentation of milk into curd enhances the bioavailability of certain B-vitamins due to microbial action.
Which of the statements given above are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

134. Which of the following statements about physical activity and nutritional needs is incorrect?
(A) Regular daily physical activity significantly increases the baseline metabolic rate and total energy expenditure.
(B) Intense physical activity promotes skeletal muscle protein synthesis, provided adequate dietary protein is available.
(C) Sedentary individuals require higher intakes of refined carbohydrates than active individuals to maintain blood glucose.
(D) Structured weight-bearing exercises enhance bone density when combined with adequate calcium and Vitamin D intake.

135. Consider the following statements:
Statement I: The "First 1000 Days" of life span from conception through the child's second birthday.
Statement II: Nutritional interventions during the first 1000 days are ineffective because human growth is entirely determined by genetics.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

136. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Consuming excessive amounts of water-soluble vitamins (like Vitamin C) generally poses a lower risk of toxicity than excessive intake of fat-soluble vitamins (like Vitamin A).
Reason (R): Excess water-soluble vitamins are readily excreted in the urine, whereas fat-soluble vitamins can accumulate in the liver and adipose tissue.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

137. A public health team is analyzing demographic data for a district. They observe that 45% of women are anemic, and 30% are clinically overweight (BMI > 25), while 35% of children under 5 are stunted. This specific scenario requires policy intervention to address:
(A) Only protein-energy malnutrition and wasting in the cohort.
(B) The double burden of malnutrition and micronutrient deficits.
(C) Exclusively environmental enteric dysfunction in small children.
(D) The highly excessive intake of bioavailable heme iron sources.

138. Which of the following correctly identifies a major limitation of using Body Mass Index (BMI) as the sole indicator of nutritional status in an individual?
(A) BMI calculations require highly complex and invasive blood biochemical panels performed in clinical laboratories.
(B) BMI is only scientifically applicable to pediatric cohorts under the age of five in rural populations.
(C) BMI does not distinguish between weight derived from muscle mass and weight derived from adipose tissue (fat).
(D) BMI equations change drastically depending on the exact geographical location and climate of the individual.

139. Match the dietary standard/guideline in List I with the organization responsible for generating it in List II (in the Indian context).
List I: (Dietary Standard/Guideline)
P. RDA for Indians
Q. Food Fortification Standards
R. National Family Health Survey Data
S. Mid-Day Meal (PM POSHAN) implementation framework
List II: (Organization)
I. FSSAI
II. ICMR-NIN
III. Ministry of Education
IV. Ministry of Health and Family Welfare (IIPS)
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-III, R-IV, S-I
(D) P-IV, Q-I, R-II, S-III

140. High consumption of highly refined cereals (like maida) with the complete removal of the bran and germ layers directly causes a dramatic reduction in the intake of which critical nutrients?
(A) Dietary fiber, B-complex vitamins, and essential minerals.
(B) Insoluble saturated fatty acids and dietary cholesterol.
(C) Readily digestible simple sugars and complex starches.
(D) Active physiological Vitamin B12 and calciferol Vitamin D.

141. Which of the following pairs is correctly matched regarding physiological states and specific nutrient demands?
(A) Pregnancy - Decreased physiological demand for dietary calcium
(B) Infancy - High relative demand for energy per kg of body weight
(C) Old age - Increased demand for total daily energy and calories
(D) Lactation - Decreased biological demand for daily fluid intake

Click Here to Buy book on Amazon

energy accumulation
III. Low height-for-age, indicating chronic restriction of growth
IV. Low weight-for-height, indicating acute recent weight loss
(A) P-IV, Q-III, R-I, S-II
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-I, R-III, S-II
(D) P-I, Q-III, R-IV, S-II

98. An excessive dietary intake of sodium coupled with inadequate potassium intake over several years alters the osmotic balance and vascular tone. This dietary pattern directly causes an increased risk of which condition?
(A) Severe vascular hypotension
(B) Clinical systemic scurvy
(C) Essential hypertension
(D) Severe night blindness

99. Which of the following pairs of specific population and its unique dietary requirement is correctly matched?
(A) Pregnant women - Decreased requirement for iron to prevent toxicity
(B) Lactating mothers - Increased requirement for energy, protein, and fluids
(C) Infants (0-6 months) - Requirement for diverse solid foods to build immunity
(D) Elderly - Increased requirement for total daily calories compared to young adults

100. If a public health strategy involves the biofortification of staple crops (e.g., zinc-rich rice), how does this concept application differ from conventional food fortification?
(A) Biofortification adds nutrients during the mechanical processing stage in factories, whereas conventional fortification occurs directly at the consumer level.
(B) Biofortification relies exclusively on strictly synthetic industrial chemicals, whereas conventional fortification utilizes natural concentrated organic extracts.
(C) Biofortification is only technically applicable to fresh agricultural fruits, whereas conventional fortification is reserved exclusively for processed cereals.
(D) Biofortification increases crop nutrient levels during plant growth via breeding or agronomy, while conventional fortification adds nutrients post-harvest.

101. All of the following are biological factors that can contribute to malnutrition, EXCEPT:
(A) Poverty and limited purchasing power
(B) Chronic parasitic infections
(C) Congenital metabolic disorders
(D) Malabsorption syndromes like celiac disease

102. A 60-year-old post-menopausal woman has a long history of inadequate calcium and Vitamin D intake. She recently suffered a fracture of her radius after a minor fall. Her bone density scan reveals severe depletion of bone mass. This clinical scenario describes which condition?
(A) Osteoarthritis
(B) Scurvy
(C) Osteoporosis
(D) Pellagra

103. What is the most appropriate reason for promoting nutrition education in schools?
(A) To inculcate healthy eating behaviors and lifestyle habits early in life, preventing both under- and overnutrition.
(B) To identify and strictly penalize students who bring processed junk food items into the school premises.
(C) To professionally train young students to become certified clinical dietitians by the age of fifteen.
(D) To significantly reduce the school's overall financial expenditure on the national mid-day meal scheme.

104. Which of the following represents the definition of "Dietary Fiber"?
(A) The fully digestible portion of animal connective tissue that provides structural bulk.
(B) Synthetic chemical polymers added to processed food products to increase retail shelf life.
(C) Highly soluble and readily absorbable simple sugars found naturally within fresh fruit juices.
(D) Non-digestible carbohydrates and lignin that are intrinsic and intact in agricultural plants.

105. Consider the following statements about protein quality:
I. Biological Value (BV) measures the proportion of absorbed protein from a food which becomes incorporated into the

NODIA

(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

150. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct option:
Assertion (A): Including a source of Vitamin C (like lemon juice) with a vegetarian meal significantly enhances iron absorption.
Reason (R): Vitamin C acts as a reducing agent, keeping iron in the more bioavailable ferrous (Fe^{2+}) state rather than the ferric (Fe^{3+}) state.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

www.nodia.in

NODIA

avidin. This biochemical interaction directly causes which effect?
(A) Scurvy due to complete failure of biochemical collagen synthesis in osteoids.
(B) Enhanced systemic intestinal absorption of Vitamin B12 within the terminal ileum.
(C) Biotin deficiency, leading to dermatitis, alopecia, and neurological symptoms.
(D) Iron toxicity arising from chronic heavy metal accumulation in hepatic tissues.

113. Which of the following pairs of nutritional deficiency and its diagnostic clinical sign is correctly matched?
(A) Vitamin C deficiency - Bitot's spots on conjunctiva
(B) Vitamin A deficiency - Bleeding gums and loose teeth
(C) Thiamine deficiency - Casal's necklace on the neck
(D) Iron deficiency - Spoon-shaped nails (Koilonychia)

114. Arrange the following stages of Vitamin A deficiency in the correct chronological order of their progression from early to severe clinical manifestation.
1. Keratomalacia (softening of cornea)
2. Night blindness
3. Corneal xerosis (drying of cornea)
4. Bitot's spots
(A) 2, 4, 3, 1
(B) 4, 2, 1, 3
(C) 2, 3, 4, 1
(D) 3, 4, 2, 1

115. All of the following are principles of a "Balanced Diet" EXCEPT:
(A) Meeting the updated RDA for all essential nutrients.
(B) Deriving maximum daily energy from saturated fats.
(C) Incorporating foods from all primary food groups.
(D) Providing a standard margin of safety for nutrients.

116. A local community shows high rates of goitre. The government has mandated the iodization of salt. However, the community continues to consume large quantities of raw cabbage, cassava, and millet. Despite using iodized salt, the goitre rates do not decrease significantly. What is the most likely reason for this phenomenon?
(A) These agricultural foods are extremely rich in iodine, causing an acute overdose effect.
(B) These fibrous foods completely destroy the cellular thyroid gland tissue during digestion.
(C) Standard table salt cannot be bioavailably absorbed when consumed with plant-based diets.
(D) These foods contain goitrogens, which interfere with iodine uptake by the thyroid gland.

117. What is the most appropriate definition of "Food Fortification"?
(A) The deliberate addition of micronutrients to food to improve nutritional quality and provide health benefits.
(B) The genetic modification of agricultural crop seeds to produce significantly larger baseline crop yields.
(C) The chemical process of preserving raw foods using highly concentrated solutions of sucrose and table salt.
(D) The commercial substitution of cheap chemical ingredients for expensive ones in consumer food production.

118. Which of the following vitamins is primarily synthesized by the normal flora (microbiome) of the human gastrointestinal tract?
(A) Vitamin C
(B) Vitamin A
(C) Vitamin K
(D) Vitamin D

119. Consider the following statements about macronutrient distribution in a balanced adult diet:
I. Carbohydrates should provide 50-60% of total daily energy.
II. Proteins should provide 10-15% of total daily energy.
III. Visible fats and invisible fats should combined provide 20-30% of total energy.
IV. Trans-fats should provide at least 5% of total energy for metabolic stability.
Which of the statements given above are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

Downloaded from www.pdf.tube

9. (B) Decrease in High-Density Lipoprotein (HDL) and increase in Low-Density Lipoprotein (LDL) levels.
Dietary trans fatty acids significantly disrupt human lipid metabolism by altering circulating lipoprotein concentrations. Consuming these hydrogenated fats lowers protective high-density lipoprotein levels while simultaneously elevating atherogenic low-density lipoprotein levels. This adverse biochemical shift increases arterial plaque accumulation, thereby raising the risk of developing coronary heart disease and associated cardiovascular complications.

10. (C) Potassium - Major macromineral nutrient
Potassium is an essential macromineral required in relatively large daily amounts to maintain cellular osmotic balance and systemic fluid regulation. Conversely, copper is classified as a micromineral or trace element. Linoleic acid is an essential fatty acid that cannot be synthesized endogenously, while thiamine is a water-soluble B-complex vitamin, not a fat-soluble one.

11. (A) 2, 3, 4, 1
Biological value measures the efficiency of protein utilization by the human body. Plant-based proteins generally have lower values due to limiting amino acids, with wheat ranking lower than soybeans. Animal-derived proteins have superior amino acid profiles, with milk being highly bioavailable and whole eggs representing the gold standard with the highest biological value score of approximately one hundred.

12. (A) Palmitic acid
Palmitic acid is a saturated fatty acid that functions primarily as a source of metabolic energy and structural lipids. It does not possess direct antioxidant properties. In contrast, ascorbic acid, alpha-tocopherol, and selenium are vital protective nutrients. These molecules neutralize reactive oxygen species, prevent lipid peroxidation, and safeguard cellular membranes from oxidative stress.

13. (B) Pellagra due to a deficiency in bioavailable niacin and tryptophan.
Maize contains niacin in a bound, unabsorbable form called niacytin and is naturally deficient in the essential amino acid tryptophan, which is a metabolic precursor to niacin. Populations relying solely on maize without alkaline processing are prone to pellagra. This deficiency state clinically manifests through the classic signs of dermatitis, diarrhea, and dementia.

NODIA

14. (B) The PDCAAS or DIAAS rating of the ingested dietary protein source.
Protein quality is evaluated based on amino acid composition and ileal digestibility. The Protein Digestibility-Corrected Amino Acid Score and the Digestible Indispensable Amino Acid Score are standard metrics used globally. These systems compare the amino acid profile of a food protein against human requirements, adjusting for digestibility to determine its overall metabolic utility.

15. (A) Glycogen
Glycogen is a highly branched polysaccharide that serves as the primary storage form of glucose in animals. It is synthesized and stored mainly in hepatocytes and skeletal muscle tissue. This carbohydrate reservoir is rapidly mobilized through glycogenolysis to maintain systemic glucose homeostasis during fasting states, muscular activity, or physiological stress.

16. (C) A comprehensive set of reference values used to plan and assess nutrient intakes of healthy people.
Dietary Reference Intakes represent a quantitative set of nutrient reference values designed for healthy populations. This framework includes several parameters used by dietitians to assess and plan diets. These values prevent nutritional deficiencies while simultaneously reducing the risk of chronic diseases, ensuring that intake levels remain within safe and physiologically optimal boundaries.

17. (A) I and III
Plant-based foods naturally lack cobalamin, which is synthesized exclusively by microorganisms and obtained via animal products or fortification. Heme iron, which possesses high bioavailability, is found only in animal flesh. Conversely, animal foods completely lack dietary fiber, and physiologically active phytochemicals are synthesized exclusively by plants to serve protective functions.

18. (C) Carbohydrates are the main energy source utilized by the human brain under normal physiological conditions.
Under standard physiological conditions, the human brain relies almost exclusively on glucose derived from carbohydrate metabolism

death if untreated. This condition is historically associated with populations reliant on maize as a staple food, where niacin is in an unabsorbable form.

77. (B) I, II, and IV
Iodine is required for the synthesis of thyroid hormones that regulate metabolism. Deficiency during pregnancy can cause cretinism, while goitre is a classic sign of deficiency, not excess. To address these risks, universal salt iodization is globally recommended to ensure adequate daily iodine intake across populations.

78. (B) Athletes require higher total energy intake, sufficient protein for muscle repair, and adequate hydration to maintain performance.
Intense physical training increases energy expenditure, requiring higher caloric intakes to maintain energy balance. Athletes require sufficient protein to support muscle repair and synthesis, along with adequate fluids to prevent dehydration and maintain cardiovascular function. A balanced intake of carbohydrates, lipids, and micronutrients optimally supports athletic performance and recovery.

79. (D) Statement I is false but Statement II is true.
Anthropometric measurements assess physical body dimensions and composition, but they cannot measure circulating vitamin levels directly. In contrast, biochemical assessments use laboratory analyses of blood or urine to evaluate nutrient concentrations. These tests are essential for detecting subclinical deficiencies before clinical signs manifest.

80. (C) A is true but R is false.
FSSAI mandates the fortification of milk and edible oil with Vitamins A and D to address widespread micronutrient deficiencies. However, Vitamins A and D are fat-soluble, not water-soluble. They are added to these fatty food carriers because they dissolve in lipids, ensuring stable and bioavailable delivery of these nutrients.

81. (D) Vitamin B12
Atrophic gastritis reduces gastric acid and intrinsic factor secretion. Acid is required to release Vitamin B12 from dietary proteins, and intrinsic factor is essential for its absorption in the terminal ileum. Therefore, this age-related reduction in gastric secretions significantly impairs B12 absorption, increasing the risk of deficiency.

82. (C) RDA values cover the nutrient requirements of only 50% of the healthy population.
The Recommended Dietary Allowance is calculated to meet the nutritional requirements of ninety-seven to ninety-eight percent of healthy individuals in a demographic. It is not designed for only fifty percent, which describes the Estimated Average Requirement. RDA values include a safety margin to account for individual variations in absorption.

83. (A) P-II, Q-IV, R-III, S-I
Food groups provide distinct nutrients: fats and oils deliver highly concentrated energy and essential lipids, green leafy vegetables provide folate, calcium, and iron, cereals and millets are primary energy and B-vitamin sources, and meat and poultry supply high-quality protein and bioavailable heme iron.

84. (D) Softening and weakening of bones, leading to skeletal deformities such as rickets.
Vitamin D is essential for intestinal calcium and phosphorus absorption, which are necessary for bone mineralization. In children, a deficiency impairs osteoid mineralization at the growth plates, leading to rickets. This presents as soft, weak bones, directly causing skeletal deformities like bowed legs and knock knees.

85. (A) Fluoride - Prevention of dental caries
Fluoride is an essential mineral that supports dental health by promoting the remineralization of tooth enamel, which helps prevent dental caries. In contrast, iron is involved in oxygen transport, calcium and phosphorus support bone structure, and Vitamin A regulates the visual cycle in the retina.

86. (C) Recall bias
Recall bias is a systematic error that occurs in dietary assessments when participants misremember or misreport their food intake. This issue is common in twenty-four-hour dietary recalls, as individuals may underreport foods perceived as unhealthy or overreport foods perceived as healthy, reducing the accuracy of the data.

87. (A) Kwashiorkor
Kwashiorkor is a form of undernutrition caused by severe protein deficiency, not overnutrition.

Click Here to Buy book on Amazon

28. (A) Neural tube defects
Folate is a crucial water-soluble vitamin required for DNA synthesis, cellular division, and neurological development. Inadequate folate intake during the early stages of pregnancy impairs the closure of the embryonic neural tube. This deficiency directly increases the incidence of severe congenital anomalies, such as spina bifida and anencephaly, in the developing fetus.

29. (B) Age 19-39 years, weighing 65 kg, healthy, and actively engaged in sedentary daily work.
Under updated Indian nutritional guidelines, the Reference Indian Man is defined as healthy, aged nineteen to thirty-nine years, weighing sixty-five kilograms, and engaged in sedentary daily activity. This standardized physical profile serves as the baseline for calculating energy requirements, metabolic rates, and recommended daily nutrient allowances for the adult male population.

30. (B) 0.83 g/kg body weight/day
National nutritional guidelines specify that the Recommended Dietary Allowance for protein is zero point eight three grams per kilogram of body weight daily for healthy adults. This value accounts for nitrogen balance studies and adjusts for safe protein utilization. Consuming this amount ensures the maintenance of lean body mass and supports basic physiological repair processes.

31. (A) A diet supplying all essential nutrients to maintain health, plus a small buffer for short periods of leanness.
A balanced diet is formulated to provide all essential macro and micronutrients in the correct proportions to support somatic functions. It includes a physiological margin of safety or buffer to sustain the body during brief intervals of dietary deprivation. This approach prevents deficiency diseases while promoting long-term metabolic health and immunological resilience.

32. (B) I, II, and IV
Standard Indian nutritional guidelines define the reference weight for adult women as fifty-five kilograms and base energy requirements on resting metabolic rate. In a balanced diet, carbohydrates should contribute fifty to sixty percent of daily energy. However, the RDA for calcium has been increased, not reduced to six hundred milligrams, to support bone health.

33. (D) EAR meets the needs of 50% of the healthy population, while RDA is designed to meet the needs of 97-98% of the population.
The Estimated Average Requirement is the nutrient intake level estimated to meet the physiological requirements of fifty percent of healthy individuals in a demographic. The Recommended Dietary Allowance is calculated using this baseline, typically adding two standard deviations to cover the nutritional needs of nearly all healthy individuals in that population.

34. (D) Statement I is false but Statement II is true.
The Tolerable Upper Intake Level is not a therapeutic target or a recommended intake level to optimize health benefits. Instead, it represents the maximum daily intake of a nutrient unlikely to cause adverse health effects. Consuming nutrients in quantities exceeding this threshold significantly increases the risk of chronic physiological toxicity and metabolic dysfunction.

35. (A) Both A and R are true and R is the correct explanation of A.
Women of reproductive age have higher iron requirements than adult men because of blood loss during menstruation. This blood loss depletes systemic iron stores, necessitating a higher daily intake to support hemoglobin synthesis. Ensuring adequate dietary iron or supplementation prevents iron deficiency anemia and maintains optimal energy levels and maternal health outcomes.

36. (D) 1000 mg
According to Indian dietary standards, the Recommended Dietary Allowance for calcium during pregnancy is one thousand milligrams per day. This elevated intake supports fetal skeletal development while preserving maternal bone mineral density. Therefore, a commercial beverage claiming to meet the full daily requirement for pregnant women must provide this specific amount per serving.

37. (A) The “Fats and Sugars” group should form the largest portion of the food pyramid to ensure sufficient caloric intake.
The food pyramid is structured to promote health by recommending that nutrient-dense foods form the base of the diet. Fats and simple sugars are calorie-dense but nutrient-poor, meaning they should be consumed sparingly. Placing them at the pyramid’s base would encourage excess

NODIA

energy intake, promoting obesity and associated cardiovascular risks.

38. (A) P-III, Q-IV, R-I, S-II
Nutritional priorities vary across the human lifespan. Infants rely on exclusive breastfeeding for ideal development. Pregnancy demands increased folate and iron to prevent neural tube defects and support maternal blood volume. The elderly require calcium and vitamin D to mitigate bone loss, while rapid adolescent growth spurts require high caloric and protein densities.

39. (A) Accumulation of pyruvic acid and lactic acid in tissues, causing peripheral neuropathy and cardiac failure.
Thiamine acts as a key cofactor for pyruvate dehydrogenase, an enzyme essential for carbohydrate metabolism. A severe deficiency of thiamine halts the aerobic pathway, leading to the accumulation of pyruvate and lactate in tissues. This biochemical blockage deprives neurons and cardiac muscles of energy, clinically presenting as wet or dry beriberi.

40. (D) Heavy worker - Stone cutter
Occupational activity levels determine the physiological energy requirements of individuals. Stone cutting requires continuous, high-intensity physical exertion and heavy muscular labor, which classifies it as heavy work. Conversely, software engineering is categorized as sedentary work, while agricultural activities are generally classified as moderate to heavy depending on the specific tasks performed.

41. (A) 1, 2, 4, 3
A balanced dietary plate is structured to optimize macronutrient and micronutrient intake. Cereals and millets should form the largest volumetric portion to provide carbohydrates. Vegetables and fruits represent the next largest group for protective nutrients, followed by pulses and legumes for protein. Fats and oils must be consumed in the smallest quantities.

42. (C) An increased demand for calories to support hyperactive organ function.
Aging is associated with a progressive decline in basal metabolic rate and reduced physical activity, which lowers overall energy requirements. It does not cause hyperactive organ function or increase caloric needs. However, the elderly require nutrient-dense diets because aging impairs the gastrointestinal absorption and metabolic utilization of essential micronutrients like cobalamin.

43. (D) Implementing a "carbohydrate loading" protocol, tapering training while increasing complex carbohydrate intake.
Carbohydrate loading is a scientifically validated dietary strategy designed to maximize muscle glycogen stores before endurance events. This protocol involves gradually tapering training volume while increasing the intake of complex carbohydrates. This combination supercompensates muscle glycogen levels, delaying fatigue and optimizing physical performance during prolonged high-intensity athletic activities.

44. (A) Foods that possess a high caloric value but little to no essential vitamins, minerals, or protein.
Empty calories refer to energy derived from foods that contain high amounts of solid fats or added sugars but lack essential micronutrients. Consuming these foods provides thermal energy without delivering vital vitamins, minerals, amino acids, or dietary fiber. This dietary pattern contributes to nutritional imbalances, weight gain, and chronic metabolic diseases.

45. (B) A specific, measurable criterion of nutritional adequacy, such as maintaining a certain enzyme or blood concentration.
Establishing the Estimated Average Requirement involves using measurable biochemical or physiological criteria of adequacy. Researchers evaluate specific markers, such as maintaining optimal blood concentrations of a nutrient or supporting key enzymatic activities. This objective data helps determine the intake level that meets the physiological requirements of half of a healthy population.

46. (B) An abnormal physiological state caused by deficient, excessive, or imbalanced intake of essential nutrients.
Malnutrition represents a broad pathological spectrum resulting from nutrient imbalances. It includes undernutrition, which encompasses wasting, stunting, and underweight states, as well as overnutrition, which leads to obesity and associated metabolic diseases. Micronutrient deficiencies, or hidden hunger, also fall under this definition, reflecting any chronic deviation from optimal nutritional intake.

Downloaded from www.pdf.tube

47. (C) I, III, and IV
The double burden of malnutrition refers to the coexistence of undernutrition and overnutrition within individuals, households, or populations. This phenomenon is driven by the consumption of affordable, calorie-dense but nutrient-poor foods. It commonly manifests as a stunted child living with an overweight mother, and it persists in low-, middle-, and high-income nations.

48. (C) Kwashiorkor results from a severe dietary protein deficit despite marginal calorie intake, while Marasmus is a severe deficiency of both calories and protein.
Kwashiorkor is characterized by a severe protein deficiency relative to energy intake, leading to hypoalbuminemia and bilateral pitting edema. In contrast, marasmus is a state of generalized starvation caused by a deficiency in both dietary protein and total calories, presenting as extreme muscle wasting and a lack of subcutaneous fat.

49. (C) Statement I is true but Statement II is false.
Chronic nutritional deficits during the critical first thousand days of life impair brain development and linear growth, leading to irreversible stunting. While catch-up growth during adolescence can improve height to some extent, it cannot fully restore neurological structures or reverse cognitive deficits caused by severe undernutrition during early infancy.

50. (A) Both A and R are true and R is the correct explanation of A.
Obesity is classified as a form of malnutrition because it stems from a chronic energy imbalance, where caloric intake exceeds metabolic expenditure. This dietary pattern often relies on highly processed foods, which can lead to concurrent micronutrient deficiencies. Therefore, individuals with obesity can experience both overnutrition of energy and undernutrition of vitamins.

51. (B) Marasmus
This clinical presentation is characteristic of marasmus, a form of severe protein-energy malnutrition caused by generalized starvation. The absence of subcutaneous fat and severe muscle wasting produce a classic wizened facial appearance. Unlike kwashiorkor, marasmus does not feature bilateral pitting edema, and children typically remain alert and show a strong appetite.

52. (D) Social factors such as female literacy rates have no measurable impact on child nutrition indices.
Social determinants, particularly female literacy, are strongly linked to child nutrition. Educated mothers are better equipped to implement optimal feeding practices, recognize illness, and manage household resources. Conversely, poverty, poor sanitation, and recurrent gastrointestinal infections impair nutrient absorption, directly contributing to the complex etiology of malnutrition in vulnerable populations.

53. (A) P-II, Q-IV, R-I, S-III
Specific nutritional deficiencies present with distinct clinical signs. Vitamin A deficiency damages ocular tissues, causing Bitot's spots. Vitamin C deficiency impairs collagen synthesis, causing bleeding gums. Vitamin D deficiency in children leads to bowed legs, while inadequate iron decreases hemoglobin levels, presenting as conjunctival pallor and persistent fatigue.

54. (C) Keratomalacia leading to blindness
Severe Vitamin A deficiency impairs the maintenance of epithelial tissues, leading to profound ocular changes. If left untreated, corneal dryness progresses to keratomalacia, which is characterized by the rapid liquefaction and necrosis of the cornea. This process causes corneal scarring and perforation, resulting in permanent and irreversible structural blindness.

55. (A) Measurement of serum albumin levels
Nutritional assessment uses various methods to evaluate health. Measuring serum albumin is a biochemical method that provides objective laboratory data on visceral protein status. Conversely, weighing an infant is an anthropometric measure, conducting a dietary recall represents a dietary assessment, and examining a patient for a goitre is a clinical examination.

56. (D) Hidden Hunger or micronutrient deficiency
Providing iron and folic acid supplements targets specific micronutrient deficits without addressing overall energy or protein intake. This intervention directly addresses hidden hunger, which is a form of malnutrition characterized by vitamin and mineral deficiencies that occur without the obvious signs of wasting or stunting, yet still severely impair cognitive and physical health.

NODIA

57. (B) Physical assessment of mid-upper arm circumference (MUAC) values.
Mid-upper arm circumference is an anthropometric indicator used to screen for muscle wasting and severe acute malnutrition. It does not involve chemical or laboratory analyses of biological specimens. In contrast, measuring hemoglobin levels, analyzing urinary iodine excretion, and evaluating serum ferritin are biochemical methods that provide direct laboratory data on nutrient status.

58. (C) Administering high-dose Vitamin A supplements biannually to vulnerable preschool children.
Periodic administration of high-dose Vitamin A supplements is a cost-effective public health strategy for communities with limited access to diverse foods. This approach builds liver reserves in preschool children, reducing the risk of nutritional blindness and mortality. While dietary diversification is the long-term goal, supplementation provides immediate protection.

59. (D) A state of chronic undernutrition representing failure to achieve expected linear growth, measured as low height-for-age.
Stunting is defined as a low height-for-age compared to standard growth references. This condition reflects chronic, long-term undernutrition or recurrent infections that impair linear skeletal growth during early childhood. Unlike wasting, which indicates acute weight loss, stunting has persistent effects on cognitive development, physical capacity, and health outcomes.

60. (A) National Family Health Survey (NFHS)
The National Family Health Survey is a multi-round survey that provides comprehensive, state-level data on health and nutrition indicators in India. It monitors key parameters, including stunting, wasting, underweight status, and anemia, across various demographics. This data is critical for designing, implementing, and evaluating national public health interventions.

61. (B) $\text{Weight}\,(\text{kg})\,/\text{Height}^2\,(\text{m}^2)$
Body Mass Index is a standard anthropometric index used to classify nutritional status in adults. It is calculated by dividing body weight in kilograms by the square of height in meters. This value helps identify underweight, normal, overweight, or obese states, serving as an indicator of body fatness in epidemiological studies.

62. (B) I, III, and IV
Iron deficiency is the leading cause of anemia, but inadequate folate and Vitamin B12 intake also contribute to this condition. Parasitic hookworm infestations cause chronic intestinal blood loss, depleting iron stores. Additionally, malaria is a biological factor that causes hemolytic anemia through the destruction of red blood cells.

63. (A) Kwashiorkor
Kwashiorkor is a form of severe acute malnutrition characterized by bilateral pitting edema in the lower extremities, which can progress to generalized swelling. This condition is caused by a severe protein deficiency despite marginal energy intake, leading to reduced intravascular oncotic pressure. It also presents with dermatosis and a fatty liver.

64. (D) Statement I is false but Statement II is true.
PM POSHAN is a school-based feeding program designed to improve the nutritional status and school enrollment of children, not pregnant women. Conversely, food fortification is an effective public health strategy that adds essential micronutrients, such as iron, folic acid, and vitamins, to staple foods to reduce deficiencies across the general population.

65. (A) Both A and R are true and R is the correct explanation of A.
Exclusive breastfeeding during the first six months of life is a critical public health practice to prevent infant malnutrition. Breastmilk delivers ideal nutrients and contains immunological factors that shield infants from gastrointestinal infections. Furthermore, breastfeeding supports the development of a healthy gut microbiome, which optimizes nutrient digestion and absorption.

66. (C) Diagnose the child with Severe Acute Malnutrition (SAM) and refer immediately to an NRC facility.
A mid-upper arm circumference measurement below one hundred and fifteen millimeters indicates severe acute malnutrition in children aged six to fifty-nine months. This finding signifies a high risk of mortality, requiring immediate clinical referral to a Nutrition Rehabilitation Center. This facility provides specialized therapeutic feeding and manages medical complications.

Click Here to Buy book on Amazon

67. (B) Stunting has been completely eradicated in all urban centers across the country.
Although urban areas often have better access to healthcare, childhood stunting remains a significant public health challenge in urban slums due to poor sanitation and food insecurity. Anemia remains prevalent among women, and the rise of overweight status alongside persistent wasting highlights the double burden of malnutrition affecting the nation.

68. (A) P-II, Q-IV, R-I, S-III
Integrated Child Development Services provide targeted nutrition to children under six and mothers. The National Iron Plus Initiative distributes iron supplements to prevent anemia, while PM POSHAN serves mid-day meals to school children. The Vitamin A Supplementation Program administers high-dose supplements to preschool children to prevent nutritional blindness.

69. (A) Intestinal villi blunting and enteric dysfunction, causing severe malabsorption and somatic wasting.
Recurrent diarrheal infections caused by poor sanitation trigger environmental enteric dysfunction. This pathology is characterized by the flattening of intestinal villi, which reduces the surface area available for nutrient absorption. This damage leads to chronic malabsorption, systemic nutrient depletion, and somatic wasting, trapping children in a cycle of infection and malnutrition.

70. (C) Clinical Examination - To detect visible signs like goitre or Bitot's spots.
Clinical examination is a direct diagnostic method used to identify physical signs of nutrient deficiencies, such as goitre or Bitot's spots. Conversely, dietary recalls assess historical food intake patterns, biochemical analyses measure nutrient levels in biological samples, and anthropometry assesses physical body dimensions like height and weight.

71. (A) 2, 4, 1, 3
Designing a community nutrition program begins with assessing nutritional status using standard anthropometric, biochemical, clinical, and dietary methods. This assessment identifies the specific deficiencies affecting the population. Once the problem is defined, targeted interventions can be implemented. Finally, systematic monitoring and evaluation assess the program's efficacy and guide future adjustments.

72. (D) Encouraging exclusive consumption of polished grains.
Encouraging the exclusive consumption of polished grains is not an effective strategy to prevent malnutrition. Polishing grains removes the nutrient-rich outer bran and germ layers, depleting essential B-vitamins, minerals, and dietary fiber. Effective strategies focus on dietary diversification, food fortification, and nutrition education to ensure sufficient intake of micronutrients.

73. (B) Prescribing oral iron and folic acid supplements alongside dietary counseling.
The presence of chronic fatigue, breathlessness, and spoon-shaped nails points to iron deficiency anemia, which is common in individuals consuming few animal products or leafy greens. The initial intervention requires oral iron and folic acid supplements to restore hemoglobin levels. Dietary counseling helps identify and incorporate local iron-rich foods.

74. (C) To empower individuals with knowledge to make healthy food choices using locally available, affordable resources.
Nutrition education primarily aims to equip individuals with the knowledge and practical skills needed to adopt healthy eating patterns. This approach utilizes affordable, locally available resources rather than expensive commercial supplements. By encouraging sustainable dietary behaviors, nutrition education helps communities prevent both undernutrition and overnutrition.

75. (D) Micronutrient deficiencies occurring without obvious clinical signs of generalized undernutrition.
Hidden hunger refers to micronutrient deficiencies that develop without visible signs of energy deficit. Individuals may consume sufficient calories to maintain body weight but lack essential vitamins and minerals, such as iron, iodine, zinc, and Vitamin A. This form of malnutrition impairs cognitive development, immune function, and physical productivity.

76. (A) Niacin (Vitamin B3)
Pellagra is a deficiency disease caused by inadequate dietary intake of niacin or its precursor tryptophan. It classically presents with dermatitis, diarrhea, dementia, and can lead to

Downloaded from www.pdf.tube

to satisfy its high energy demands. Proteins and carbohydrates yield approximately four kilocalories per gram, whereas lipids yield nine. Although water is crucial for life and cellular hydrolysis, it does not provide any caloric energy.

19. (A) Both Statement I and Statement II are true.
The Estimated Average Requirement is the daily nutrient intake level estimated to meet the needs of half the healthy individuals in a demographic group. The Recommended Dietary Allowance is statistically derived from this value. By adding two standard deviations to the average requirement, the resulting allowance covers the nutritional needs of nearly all healthy individuals.

20. (C) A is true but R is false.
Non-heme iron found in plant foods is less bioavailable and absorbed at a lower rate than animal-based heme iron. This lower absorption is due to its ferric state and the presence of dietary inhibitors. Phytates and tannins chemically bind non-heme iron, forming insoluble complexes that impede intestinal absorption rather than enhancing the process.

21. (A) Establish the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects.
The Tolerable Upper Intake Level defines the maximum amount of a nutrient that can be consumed daily without posing health risks to nearly all individuals. This parameter is crucial for evaluating supplement safety and preventing toxicity. It does not represent a recommended therapeutic target, but rather a safety threshold to avoid chronic physiological complications.

22. (C) A balanced diet for an adult must consist of at least 70% of total calories from pure dietary fats.
A balanced diet must provide macronutrients within established physiological ranges to maintain optimal metabolic health. Obtaining seventy percent of total daily calories from dietary fats is excessive and contradicts public health guidelines. Standard recommendations advise that carbohydrates should provide the majority of daily energy, while lipids should contribute between twenty and thirty percent.

23. (A) P-II, Q-IV, R-I, S-III
Dietary Reference Intakes are structured around specific scientific parameters. The Recommended Dietary Allowance meets the needs of nearly all healthy individuals, while the Estimated Average Requirement covers half. Adequate Intake is established when scientific evidence is insufficient to determine a requirement. The Tolerable Upper Intake Level indicates the maximum safe daily consumption limit.

NODIA

24. (D) Increased production of ketone bodies leading to nutritional ketosis.
When dietary carbohydrates are severely restricted, systemic glucose levels fall, prompting the mobilization of fatty acids. The liver metabolizes these lipids into acetoacetate and beta-hydroxybutyrate, which serve as water-soluble energy substrates for the brain. This physiological adaptation elevates blood ketone concentrations, resulting in a metabolic state known as nutritional ketosis.

25. (B) Vitamin B12 - Fermented organic plant foods
Cobalamin is synthesized exclusively by bacteria and is not naturally present in plant tissues. Although some fermented plant foods contain trace amounts of vitamin B12 analogues, they are often inactive or insufficient to meet human nutritional requirements. Reliable dietary sources are limited to animal products, dairy, or commercially fortified plant matrices.

26. (C) Adding a squeeze of fresh lemon juice (Vitamin C) to the meal.
Non-heme iron in plant foods like spinach and lentils exists primarily in the insoluble ferric state. Ascorbic acid present in fresh lemon juice acts as a potent reducing agent. It converts ferric iron into the highly soluble ferrous form within the duodenum, significantly enhancing its bioavailability and absorption across the intestinal mucosal border.

27. (D) Maximum Residue Limit (MRL)
The Dietary Reference Intakes framework comprises nutritional reference values including the Estimated Average Requirement, Recommended Dietary Allowance, and Tolerable Upper Intake Level. These parameters guide nutrient intake in healthy populations. Conversely, the Maximum Residue Limit is a toxicological and regulatory standard that defines the maximum safe limit of chemical pesticide residues in agricultural products.

Conversely, chronic overnutrition, characterized by excessive caloric intake relative to expenditure, leads to obesity. This energy imbalance is a major risk factor for developing chronic diseases, including Type 2 Diabetes, hypertension, and cardiovascular disease.

88. (D) Folic acid supplementation
Neural tube defects are congenital anomalies linked to inadequate maternal folate status during early gestation. Ensuring adequate folic acid intake among women of childbearing age is critical for embryonic development. Supplementation before and during early pregnancy reduces the incidence of these defects, making it a key public health intervention.

89. (B) The proportion of an ingested nutrient that is absorbed and utilized by the body for bodily functions.
Bioavailability refers to the fraction of an ingested nutrient that is absorbed through the gastrointestinal tract and enters systemic circulation for utilization. This parameter is influenced by the chemical form of the nutrient, interactions with other dietary compounds, and host factors such as digestive health and nutrient status.

90. (C) The highest daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals.
The Tolerable Upper Intake Level is a safety threshold within the Dietary Reference Intakes framework. It represents the highest daily intake of a nutrient that is unlikely to cause adverse health effects in almost all individuals in a demographic. Consuming nutrients above this level increases the risk of toxicity.

91. (B) I, III, and IV
Nutritional assessment parameters help identify different forms of malnutrition. BMI-for-age is used to evaluate overweight status in children, and weight-for-height indicates wasting. Bilateral pitting edema is a diagnostic clinical sign of severe acute malnutrition. However, the waist-to-hip ratio is used to evaluate abdominal adiposity, not clinical vitamin deficiencies.

92. (A) Undernutrition results from inadequate intake of nutrients, whereas overnutrition is caused by excessive intake of dietary energy.
Undernutrition is a state of nutrient deficiency where intake fails to meet physiological needs, presenting as wasting, stunting, or underweight. Overnutrition occurs when energy intake consistently exceeds metabolic expenditure, leading to abnormal fat accumulation and obesity. Both states represent forms of malnutrition that can coexist within the same population.

93. (A) Both Statement I and Statement II are true.
Rickets is a childhood skeletal disorder caused by a deficiency in Vitamin D, calcium, or phosphate, which impairs the mineralization of growing bone plates. Osteomalacia is the adult equivalent that occurs after growth plate fusion, characterized by impaired remodeling and softening of the bone matrix, which increases bone pain and fracture risk.

94. (A) Both A and R are true and R is the correct explanation of A.
Promoting kitchen gardens is an effective strategy to address micronutrient deficiencies, or hidden hunger. These gardens provide households with direct access to diverse, fresh produce, such as green leafy vegetables and yellow fruits. This access increases the intake of essential vitamins and minerals, improving dietary quality and nutritional outcomes.

95. (A) Introduce amla, citrus fruits, and guava into his daily diet.
The presentation of bleeding gums, joint pain, and delayed wound healing indicates scurvy, a deficiency disease caused by a lack of Vitamin C. Ascorbic acid is required for collagen synthesis, which maintains connective tissues. Introducing Vitamin C-rich foods, such as amla, citrus fruits, and guava, resolves these deficiency symptoms.

96. (C) Economic prosperity of a household guarantees the complete absence of nutritional deficiencies among its members.
While economic prosperity significantly improves overall food access, it does not guarantee the complete absence of nutritional deficiencies. High-income households may consume diets high in calories but low in micronutrients, leading to hidden hunger or overnutrition. Social factors, disease burden, and dietary choices also influence the nutritional status of individuals.

Click Here to Buy book on Amazon

97. (A) P-IV, Q-III, R-I, S-II
Nutritional indicators identify different forms of growth failure. Wasting is defined as low weight-for-height, reflecting acute weight loss. Stunting is low height-for-age, indicating chronic growth restriction. Underweight is low weight-for-age, a composite index of both acute and chronic malnutrition, while overweight is high weight-for-height, reflecting excessive body fat.

98. (C) Essential hypertension
High sodium intake coupled with inadequate potassium intake disrupts cellular osmotic balance and increases vascular resistance. This electrolyte imbalance promotes fluid retention and arterial constriction, raising systemic blood pressure. Over time, this chronic physiological stress increases the risk of developing essential hypertension and associated cardiovascular diseases.

99. (B) Lactating mothers - Increased requirement for energy, protein, and fluids
Lactation increases physiological demands to support breastmilk production. Lactating mothers require additional energy, high-quality protein, and fluids to meet these metabolic costs without depleting maternal nutrient stores. Conversely, pregnant women require more iron, infants under six months require exclusive breastfeeding, and the elderly have lower energy needs.

100. (D) Biofortification increases crop nutrient levels during plant growth via breeding or agronomy, while conventional fortification adds nutrients post-harvest.
Biofortification differs from conventional fortification in its timing and method. It uses plant breeding or agronomy to increase the micronutrient content of crops during growth. Conventional fortification adds nutrients to foods post-harvest during processing. Both strategies aim to reduce micronutrient deficiencies, but biofortification is more sustainable for rural agricultural communities.

101. (A) Poverty and limited purchasing power
Poverty and limited purchasing power are socioeconomic factors, not biological ones. Biological factors that contribute to malnutrition include chronic parasitic infections, which impair nutrient absorption, congenital metabolic disorders, and malabsorption syndromes like celiac disease. These biological factors directly interfere with the digestion, absorption, and metabolic utilization of nutrients.

102. (C) Osteoporosis
A chronic deficiency in calcium and Vitamin D, combined with post-menopausal estrogen decline, accelerates bone resorption. This imbalance leads to osteoporosis, a skeletal disorder characterized by compromised bone strength and depleted bone mass. This condition increases bone fragility, making individuals highly susceptible to fractures even from low-impact falls.

103. (A) To inculcate healthy eating behaviors and lifestyle habits early in life, preventing both under- and overnutrition.
School-based nutrition education is designed to establish healthy dietary habits during childhood. By teaching students about balanced diets and lifestyle choices, these programs support long-term wellness and prevent malnutrition. Establishing these behaviors early reduces the risk of childhood obesity, stunting, and the development of chronic metabolic diseases later in life.

104. (D) Non-digestible carbohydrates and lignin that are intrinsic and intact in agricultural plants.
Dietary fiber consists of non-digestible plant carbohydrates and lignin that resist enzymatic digestion in the human small intestine. These compounds pass into the large intestine, where they undergo partial or complete fermentation by colonic bacteria. Fiber supports laxation, regulates blood glucose, and helps maintain healthy blood lipid levels.

105. (D) I, II, III, and IV
Protein quality is evaluated using biological value and net protein utilization. Plant proteins are often incomplete due to limiting amino acids; cereals are typically deficient in lysine, while legumes are deficient in methionine. Combining these food groups provides a complete amino acid profile, maximizing overall protein quality in vegetarian diets.

106. (C) Age 20-39 years, weighing 55 kg, healthy, non-pregnant, and non-lactating.
Under Indian nutritional standards, the Reference Indian Woman is defined as healthy, aged twenty to thirty-nine years, weighing fifty-five kilograms, and non-pregnant and non-lactating. This profile serves as a baseline for determining dietary guidelines, calculating energy requirements, and

NODIA

establishing recommended daily nutrient intakes for the adult female population.

107. (D) Statement I is false but Statement II is true.
Universal salt iodization is designed to prevent iodine deficiency disorders, not iron deficiency anemia. Iodine is essential for the synthesis of thyroid hormones, which regulate metabolic processes. This mineral is highly critical for fetal and infant brain development, and a deficiency during pregnancy can cause irreversible cognitive impairment.

108. (A) Both A and R are true and R is the correct explanation of A.
Undernourished pregnant women are at higher risk of delivering low birth weight infants due to intrauterine growth restriction. This outcome can perpetuate malnutrition across generations, as these infants are more susceptible to stunting and developmental delays. Adequate maternal nutrition is essential to support fetal growth and break this cycle.

109. (B) Skim milk powder and lipid-dense peanut paste.
Ready-to-Use Therapeutic Food is designed for the outpatient management of severe acute malnutrition. It must be energy-dense, high in protein, and resistant to microbial growth without requiring water. A formulation of skim milk powder and peanut paste provides essential amino acids, lipids, and micronutrients in a stable, easily consumable format.

110. (B) The iron requirement during pregnancy can be entirely met through a normal vegetarian diet without any supplements.
Pregnancy significantly increases iron requirements to support maternal blood volume expansion and fetal development. This demand is difficult to meet through a vegetarian diet alone because non-heme iron has low bioavailability. Therefore, routine iron and folic acid supplementation is recommended for pregnant women to prevent gestational anemia and support fetal health.

111. (A) P-IV, Q-II, R-III, S-I
Dietary guidelines encourage eating a variety of foods to ensure adequate intake of essential nutrients. Pregnant and lactating women require extra food to support tissue growth and milk production. Restricting sodium intake helps prevent hypertension, and drinking sufficient water is necessary to maintain hydration and support renal filtration.

112. (C) Biotin deficiency, leading to dermatitis, alopecia, and neurological symptoms.
Raw egg whites contain avidin, a glycoprotein that binds biotin with high affinity, preventing its absorption in the gastrointestinal tract. Chronic consumption of raw egg whites can induce biotin deficiency, which impairs carboxylase enzymes involved in fatty acid synthesis and gluconeogenesis. This presents as dermatitis, hair loss, and neurological symptoms.

113. (D) Iron deficiency - Spoon-shaped nails (Koilonychia)
Koilonychia, or spoon-shaped nails, is a clinical sign associated with chronic iron deficiency anemia. In contrast, Bitot's spots are caused by Vitamin A deficiency, bleeding gums indicate Vitamin C deficiency, and Casal's necklace is a dermatological sign of pellagra, which is caused by a niacin vitamin deficiency.

114. (A) 2, 4, 3, 1
Vitamin A deficiency progresses through distinct clinical stages as systemic retinol stores are depleted. The earliest functional symptom is night blindness. This is followed by the appearance of Bitot's spots on the conjunctiva. If the deficiency persists, it leads to corneal xerosis, and ultimately to keratomalacia, which causes irreversible blindness.

115. (B) Deriving maximum daily energy from saturated fats.
A balanced diet should meet recommended dietary allowances by incorporating diverse foods while keeping saturated fats within safe limits. Public health guidelines recommend deriving most daily energy from complex carbohydrates and unsaturated fats, as excessive consumption of saturated fats raises cholesterol levels and increases the risk of cardiovascular disease.

116. (D) These foods contain goitrogens, which interfere with iodine uptake by the thyroid gland.
Goitrogens are naturally occurring compounds found in foods like cabbage, cassava, and millet. These substances interfere with thyroid function by inhibiting iodine uptake or thyroid hormone synthesis. Consuming large quantities of goitrogenic foods can limit the effectiveness

Downloaded from www.pdf.tube

Dioxide modified atmosphere
(D) Using vacuum packaging combined with high moisture barrier films

15. Identify the incorrect pair regarding microbial growth parameters.
(A) Psychrotrophs - Optimum growth below 15°C but capable of growth at refrigeration
(B) Halophiles - Require low osmotic pressure and zero salt to survive
(C) Mesophiles - Optimum growth between 30°C and 40°C
(D) Thermophiles - Minimum growth temperature generally above 45°C

16. What is the generally accepted minimum water activity (a_w) required for the growth of most spoilage moulds?
(A) 0.95
(B) 0.90
(C) 0.80
(D) 0.60

17. Consider the following statements about relative humidity (RH) as an extrinsic factor:
I. Foods with low a_w stored in high RH environments will absorb moisture.
II. High RH favors the rapid growth of moulds on the surface of foods.
III. The a_w of a food will eventually equilibrate with the RH of the storage atmosphere.
IV. Relative humidity has no impact on foods sealed in highly permeable packaging.
Which of the statements given above are correct?
(A) I, II and III
(B) I, III and IV
(C) II and IV only
(D) I, II, III and IV

18. Consider the following statements regarding Hurdle Technology:
Statement I: The application of multiple mild preservation factors to secure microbial stability is known as Hurdle Technology.
Statement II: In Hurdle Technology, the hurdles must always act independently without any synergistic effects to prevent microbial adaptation.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

19. Match the term in List I with its corresponding description in List II.
List I: (Term)
P. Antagonism
Q. Synergism
R. Commensalism
S. Amensalism
List II: (Description)
I. One microorganism benefits while the other is unaffected.
II. One microorganism produces a substance that completely inhibits another.
III. Microorganisms mutually benefit, enhancing survival.
IV. The presence of one species suppresses the growth of a competing species.
(A) P-IV, Q-III, R-I, S-II
(B) P-II, Q-III, R-I, S-IV
(C) P-IV, Q-I, R-III, S-II
(D) P-II, Q-I, R-III, S-IV

20. Which of the following statements about the stationary phase in the microbial growth curve is incorrect?
(A) Depletion of essential nutrients and carbon sources triggers the onset of this phase.
(B) Toxic secondary metabolites and organic wastes accumulate rapidly in the food matrix.
(C) Spore-forming bacterial species frequently initiate active sporulation during this phase.
(D) The total number of viable bacterial cells strictly decreases at an exponential rate.

21. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Clostridium botulinum spores cannot germinate and produce toxin in foods with a pH below 4.6.
Reason (R): High acidity causes the rapid thermal degradation of the botulinum toxin prior to ingestion.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

by megaloblastic red blood cells and potential neurological damage.

127. (A) Polyunsaturated Fatty Acids (PUFA) - Sunflower oil
Sunflower oil is a rich source of polyunsaturated fatty acids, such as linoleic acid. Saturated fatty acids are predominant in solid fats like butter and coconut oil, while monounsaturated fatty acids are abundant in olive oil. Trans fats are primarily found in partially hydrogenated vegetable oils used in processed foods.

128. (C) Clinical intervention study (Randomized Controlled Trial)
Administering a specific nutrient supplement to evaluate its effect on a health outcome represents a clinical intervention study. This methodology allows researchers to establish cause-and-effect relationships by comparing an intervention group with a control group. This design differs from observational studies, which only identify associations without active manipulation.

129. (D) Stearic acid
Stearic acid is an eighteen-carbon saturated fatty acid that can be synthesized endogenously by the human body, classifying it as non-essential. In contrast, linoleic acid and alpha-linolenic acid are essential fatty acids that must be obtained from the diet. Arachidonic acid can be synthesized from linoleic acid, making it conditionally essential.

130. (C) Promoting the cultivation and consumption of local dark green leafy vegetables and yellow fruits.
While high-dose supplementation provides immediate protection against Vitamin A deficiency, dietary diversification is a more sustainable long-term strategy. Promoting the cultivation and consumption of local beta-carotene-rich foods, such as dark green leafy vegetables and yellow fruits, provides a continuous, community-led source of Vitamin A, reducing dependence on external aid.

131. (B) The ratio of essential nutrients provided by a food relative to its total baseline caloric content.
Nutrient density refers to the amount of essential nutrients, such as vitamins, minerals, and protein, a food provides relative to its energy content. Nutrient-dense foods, like vegetables, fruits, and lean proteins, deliver high nutrient levels with fewer calories, whereas energy-dense foods often provide empty calories with little nutritional value.

132. (D) Iron
Iron is the central metal ion in the heme group of the hemoglobin molecule. It binds oxygen reversibly, enabling red blood cells to transport oxygen from the lungs to tissues throughout the body. A deficiency of iron reduces hemoglobin synthesis, directly leading to microcytic, hypochromic anemia and impaired physical capacity.

133. (B) I, III, and IV
Milk is a rich source of calcium and high biological value protein. Pasteurization heats milk to eliminate pathogens, making it safe for consumption. Fermentation of milk into curd increases the bioavailability of certain B-vitamins. However, milk is naturally low in Vitamin C and iron, which must be obtained from other dietary sources.

134. (C) Sedentary individuals require higher intakes of refined carbohydrates than active individuals to maintain blood glucose.
Sedentary individuals have lower energy expenditure and do not require high intakes of refined carbohydrates, which can lead to weight gain and insulin resistance. Active individuals require more carbohydrates to replenish glycogen stores. Regular physical activity increases metabolic rate, supports muscle protein synthesis, and enhances bone density when calcium intake is adequate.

135. (C) Statement I is true but Statement II is false.
The first thousand days of life, from conception through a child's second birthday, represent a critical window for growth and development. Nutritional interventions during this period are highly effective, as undernutrition can lead to irreversible stunting and cognitive deficits. Early nutrition, alongside genetics, plays a vital role in determining long-term health outcomes.

136. (A) Both A and R are true and R is the correct explanation of A.
Water-soluble vitamins are generally not stored in large amounts in the body, as excesses are excreted in urine, reducing toxicity risk. Fat-soluble vitamins, however, are stored in the liver and adipose tissue, allowing them to accumulate to toxic levels. This difference in storage makes

Click Here to Buy book on Amazon

overconsumption of fat-soluble vitamins more likely to cause adverse effects.

137. (B) The double burden of malnutrition and micronutrient deficits.
The presence of stunting in children alongside overweight status and high anemia rates in women indicates the double burden of malnutrition. This scenario is characterized by the coexistence of undernutrition, micronutrient deficiencies, and overnutrition within the same community. It requires integrated public health interventions that address dietary quality rather than just energy intake.

138. (C) BMI does not distinguish between weight derived from muscle mass and weight derived from adipose tissue (fat).
Body Mass Index is calculated using only weight and height, meaning it cannot differentiate between muscle mass and adipose tissue. For example, muscular individuals may be classified as overweight or obese despite having very low body fat. While useful for population-level screening, BMI has limitations when evaluating individual body composition.

139. (A) P-II, Q-I, R-IV, S-III
In India, the Indian Council of Medical Research-National Institute of Nutrition establishes Recommended Dietary Allowances. The Food Safety and Standards Authority of India sets fortification standards. The National Family Health Survey is conducted by the International Institute for Population Sciences, and the Ministry of Education implements the PM POSHAN scheme.

140. (A) Dietary fiber, B-complex vitamins, and essential minerals.
Refining cereals removes the outer bran and germ layers, which contain most of the fiber, minerals, and B-complex vitamins. The remaining endosperm is mainly starch, providing energy but far fewer micronutrients. Consuming highly refined grains increases the risk of nutritional deficiencies and metabolic disorders compared to eating intact whole grains.

141. (B) Infancy - High relative demand for energy per kg of body weight
Infants have high energy and nutrient requirements per kilogram of body weight to support rapid growth and physiological development. Conversely, pregnancy increases calcium needs, lactation raises fluid requirements, and old age reduces overall energy needs due to a lower metabolic rate. Tailoring nutrition to these life stages supports optimal health outcomes.

NODIA

142. (A) 2, 4, 3, 1
Nutritional assessment methods range in invasiveness and complexity. Mid-upper arm circumference is a rapid, non-invasive screening tool. Clinical examination for signs of deficiency is also non-invasive but requires expertise. Detailed dietary records are more complex, requiring active participant cooperation, while biochemical blood analysis is the most invasive but precise diagnostic method.

143. (A) Hyperthyroidism (Graves' disease)
Iodine deficiency reduces the synthesis of thyroid hormones, leading to hypothyroidism and compensatory enlargement of the thyroid gland, or goitre. It also impairs cognitive development, causing cretinism in severe cases. Conversely, Graves' disease is an autoimmune form of hyperthyroidism characterized by hormone overproduction, which is not caused by iodine deficiency.

144. (C) Economic growth failing to translate into improved nutritional status due to loss of dietary diversity.
Shifting from diverse food crops to a single cash crop can increase household income but reduce dietary diversity if families rely on purchased, refined foods. This shift can worsen nutritional status, leading to anemia and stunting in children. This scenario highlights that economic growth alone does not guarantee improved nutritional outcomes.

145. (D) Checking for the presence of the +F logo and conducting chemical analysis for iodine content in ppm.
To verify if commercial salt is adequately fortified, a Food Safety Officer looks for the +F logo, which indicates approved fortification. Chemical analysis is used to measure iodine content in parts per million to ensure it meets regulatory standards. Visual checks and taste tests cannot determine the presence or concentration of iodine.

146. (C) Tryptophan
Tryptophan is an essential amino acid that serves as a precursor for several physiological compounds.

It is metabolized into the neurotransmitter serotonin, which regulates mood and sleep. Additionally, tryptophan can be converted into niacin in the liver. A dietary deficiency in tryptophan or niacin can impair these pathways, leading to pellagra.

NODIA

147. (B) I, III, and IV
Essential nutrients cannot be synthesized endogenously and must be obtained from the diet, such as Vitamin C. Non-essential nutrients can be synthesized by the body; for example, the liver produces cholesterol to meet physiological needs. However, non-essential nutrients are still required for metabolic processes, meaning they are functionally very important.

148. (D) All dietary fiber is completely broken down into glucose by human digestive enzymes in the large intestine.
Humans lack the digestive enzymes required to break down dietary fiber, meaning it passes undigested through the small intestine. In the large intestine, some fibers are fermented by anaerobic bacteria, producing short-chain fatty acids rather than glucose. Carbohydrate, protein, and lipid digestion rely on specific enzymes and bile secretions for absorption.

149. (A) Both Statement I and Statement II are true.
Scurvy is characterized by bleeding gums, poor wound healing, and bruising. This condition is caused by a Vitamin C deficiency, which impairs collagen synthesis. Ascorbic acid is a required cofactor for the enzymes lysyl and prolyl hydroxylase, which stabilize the collagen triple helix. Inadequate collagen synthesis leads to blood vessel fragility.

150. (A) Both A and R are true and R is the correct explanation of A.
Consuming Vitamin C with a vegetarian meal increases the absorption of non-heme iron. Non-heme iron in plant foods exists mainly in the insoluble ferric form. Vitamin C acts as a reducing agent, converting it to the soluble ferrous form in the duodenum. This chemical reduction prevents the formation of insoluble iron complexes, enhancing bioavailability.

30. Which of the following is the most appropriate reason for considering microorganisms as having "detrimental effects" on food quality?
(A) They actively produce organic acids that lower the pH and extend the food's shelf life.
(B) They generate volatile flavor compounds like diacetyl, acetoin, and ethanol in dairy matrices.
(C) They cause organoleptic degradation through active proteolysis, lipolysis, and gas production.
(D) They synthesize essential B-group vitamins and highly active bioactive peptides during fermentation.

31. Which group of microorganisms is primarily responsible for the lactic acid fermentation of foods such as curd and sauerkraut?
(A) Fungal genera such as Aspergillus and Penicillium involved in ripening
(B) Bacterial genera Lactobacillus, Lactococcus, and Leuconostoc in fermentation
(C) Yeast genera such as Saccharomyces and Candida utilized in beverage fermentation
(D) Spoilage bacterial genera such as Pseudomonas and Flavobacterium in raw milk

32. Consider the following statements regarding fermented foods:
I. Fermentation enhances the nutritional value of food by biosynthesizing vitamins.
II. Fermentation relies exclusively on anaerobic respiration of carbohydrates.
III. Fermentation can reduce anti-nutritional factors present in raw ingredients.
IV. Fermentation decreases the shelf-life of food by breaking down complex carbohydrates.
Which of the statements given above are correct?
(A) I and III only
(B) I, II and III
(C) II and IV only
(D) I, III and IV

33. Consider the following statements regarding lactic acid bacteria fermentation:
Statement I: Homofermentative lactic acid bacteria produce lactic acid as the sole major product of glucose fermentation.
Statement II: Heterofermentative lactic acid bacteria produce lactic acid, ethanol/acetic acid, and carbon dioxide from glucose.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

34. Match the fermented food in List I with the primary microorganisms involved in its production in List II.
List I: (Fermented food)
P. Sauerkraut
Q. Beer
R. Tempeh
S. Yogurt (Curd)
List II: (Microorganisms)
I. Rhizopus oligosporus
II. Lactobacillus bulgaricus & Streptococcus thermophilus
III. Leuconostoc mesenteroides & Lactobacillus plantarum
IV. Saccharomyces cerevisiae
(A) P-III, Q-IV, R-I, S-II
(B) P-III, Q-I, R-IV, S-II
(C) P-II, Q-IV, R-I, S-III
(D) P-IV, Q-III, R-II, S-I

35. Which of the following statements about cheese production is incorrect?
(A) Penicillium roqueforti is a bacterial starter culture specifically used to ripen blue-veined cheeses.
(B) Rennet is an enzyme complex used to coagulate milk proteins during commercial cheese making.
(C) Propionic acid bacteria are directly responsible for the characteristic eye formation in Swiss cheese.
(D) Ripening involves complex biochemical changes in texture and flavor mediated by microbial enzymes.

36. Given below are an Assertion (A) and a Reason (R).
Assertion (A): The fermentation of idli batter involves a spontaneous fermentation process.
Reason (R): Microorganisms naturally present on the rice and black gram (urad dal) initiate and carry out the fermentation without the addition of an external starter culture.
(A) Both A and R are true and R is the correct explanation of A.

Downloaded from www.pdf.tube

6. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Most pathogenic bacteria cannot grow in foods with a water activity (a_w) below 0.85.
Reason (R): Low water activity disrupts cellular osmotic balance, preventing nutrient uptake and cellular division in bacteria.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

7. Which of the following defines an "implicit factor" in food microbiology?
(A) Environmental storage conditions, including ambient temperature, relative humidity, and surrounding gases.
(B) Inherited physicochemical properties of the food matrix, including pH, acidity, and nutrient profiles.
(C) Technological processing methods applied to the food, such as thermal pasteurization and irradiation.
(D) Inherent physiological properties of the microorganisms, including growth rates, synergism, and antagonism.

8. A food processor wants to formulate a shelf-stable sauce. By lowering the pH to 3.8 and adding sodium benzoate, the processor is applying which of the following concepts?
(A) Hurdle technology
(B) Thermal death kinetics
(C) Competitive exclusion
(D) Extrinsic factor manipulation

9. Arrange the typical phases of a microbial growth curve in an actively spoiling closed food system in the correct chronological order:
I. Log phase
II. Decline (Death) phase
III. Lag phase
IV. Stationary phase
(A) I, III, IV, II
(B) III, I, IV, II
(C) III, IV, I, II
(D) I, IV, III, II

10. Identify the correct pair of a naturally occurring intrinsic antimicrobial and its source.
(A) Lactoperoxidase - Garlic
(B) Eugenol - Cloves
(C) Allicin - Cow's milk
(D) Ovotransferrin - Apples

NODIA

11. A Food Safety Officer inspects a dairy facility where raw milk is stored in an open vat at 30°C with high relative humidity. The milk sours rapidly. The rapid souring is primarily driven by which specific combination of factors?
(A) Ambient storage temperature and nutrient availability
(B) High baseline alkalinity and reduced redox potential
(C) Reduced water activity and high environmental humidity
(D) Natural antimicrobial depletion and implicit antagonism

12. All of the following are extrinsic factors that affect microbial growth in food, EXCEPT:
(A) Storage temperature
(B) Relative humidity of the environment
(C) Oxidation-reduction potential of the food
(D) Concentration of gases in the storage atmosphere

13. Which of the following statements is correct regarding the role of the lag phase of the microbial growth curve?
(A) The microbial population undergoes active division and doubles at a constant exponential rate.
(B) Microorganisms transition into a dormant vegetative state and exhibit zero metabolic activity.
(C) The rate of new cellular division precisely equals the rate of cellular death in the system.
(D) Cells actively adapt to the new environment, synthesizing vital RNA, proteins, and enzymes.

14. As a food technologist, if you need to design a packaging system to strictly limit aerobic spoilage of fresh meat while maintaining its red color, which gaseous environment manipulation is most competent?
(A) Packaging with 100% pure Nitrogen gas to exclude all oxygen
(B) Packaging with 100% pure Carbon Dioxide to suppress microbes
(C) Using high Oxygen and elevated Carbon

of salt iodization programs, leading to persistent goitre in those populations.

117. (A) The deliberate addition of micronutrients to food to improve nutritional quality and provide health benefits.
Food fortification is a public health strategy that involves adding essential vitamins and minerals to commonly consumed staple foods. This intervention aims to address nutrient deficiencies across populations without requiring changes in dietary habits. Examples include fortifying salt with iodine, and adding iron, folic acid, and B-vitamins to wheat flour.

118. (C) Vitamin K
Vitamin K is a fat-soluble vitamin that is synthesized by the symbiotic bacteria in the human large intestine. This endogenous production contributes to meeting human requirements, supporting blood coagulation pathways and bone metabolism. Dietary sources remain necessary, but the intestinal microbiota provides an important baseline source of this essential nutrient.

119. (A) I, II, and III
Public health guidelines recommend that carbohydrates provide fifty to sixty percent, proteins ten to fifteen percent, and total fats twenty to thirty percent of daily energy. This distribution supports metabolic functions while reducing the risk of chronic disease. In contrast, industrial trans fats should be minimized or avoided entirely.

120. (D) Combining cereals (low lysine) and pulses (low methionine) in a meal to provide a complete amino acid profile.
Mutual supplementation is a dietary strategy used to improve protein quality in vegetarian diets. Cereals are typically deficient in lysine but contain methionine, while pulses are deficient in methionine but rich in lysine. Consuming these food groups together provides a balanced amino acid profile, enhancing the biological value of plant proteins.

121. (D) Statement I is false but Statement II is true.
Anthropometric measurements, such as height-for-age or weight-for-age, are dependent on age and sex. Growth standards and Z-score calculations compare an individual's measurements against reference values for the same age and sex. These demographic factors must be considered to accurately assess growth patterns and identify stunting or wasting.

122. (A) Both A and R are true and R is the correct explanation of A.
The elderly are highly vulnerable to malnutrition due to age-related changes, including a decline in appetite and poor dentition. Reduced gastric secretions can impair the absorption of key nutrients, while chronic illnesses further complicate dietary intake. These physiological and pathological shifts increase nutritional risk despite their lower energy requirements.

123. (D) Double burden of malnutrition (overnutrition of calories paired with undernutrition of micronutrients).
This individual exhibits the double burden of malnutrition, where high intake of calorie-dense but nutrient-poor foods leads to obesity alongside micronutrient deficiencies. While energy intake is excessive, the lack of fresh produce and protein causes deficiencies in essential vitamins, illustrating that overnutrition and undernutrition can coexist.

124. (A) Dehydration enhances the physical performance and endurance of athletes by reducing body weight.
Dehydration impairs, rather than enhances, athletic performance by reducing blood volume and cardiac output, which accelerates fatigue. It also compromises thermoregulation, increasing the risk of heat illness. Chronic dehydration reduces urine volume, elevating solute concentrations and significantly increasing the risk of developing renal calculi over time.

125. (A) P-II, Q-I, R-IV, S-III
Nutritional assessment methods utilize specific tools: anthropometry uses a stadiometer to measure physical height, dietary assessment uses food frequency questionnaires, clinical assessment involves examining physical tissues like the conjunctiva for deficiency signs, and biochemical assessment relies on laboratory analyses of blood or urine samples.

126. (B) Pernicious anemia
Intrinsic factor is a glycoprotein secreted by gastric parietal cells that is required for the absorption of Vitamin B12 in the terminal ileum. A deficiency of intrinsic factor impairs B12 absorption, leading to pernicious anemia. This condition is characterized

Click Here to Buy book on Amazon

22. How is the D-value (Decimal reduction time) defined in thermal death kinetics?
(A) The processing time required to completely destroy 100% of a microbial population at a given constant temperature.
(B) The specific temperature increase required to reduce the thermal death time of a target organism by a factor of 10.
(C) The time required to achieve a 1-log reduction (90% destruction) of a specific microbial population at a given temperature.
(D) The absolute thermal energy required to reduce the total microbial load to safe, commercially acceptable sterile levels.

23. A food scientist is calculating the thermal processing time for a canned low-acid food. If the D_{121}-value for the target spore is 0.2 minutes, what is the required holding time at 121°C to achieve a standard 12-D reduction?
(A) 1.2 minutes
(B) 2.4 minutes
(C) 12 minutes
(D) 24 minutes

24. What is the primary effect of manipulating the gaseous environment by elevating CO_2 levels to 20-30% in packaged fresh meats?
(A) It significantly extends the lag phase of aerobic spoilage bacteria like Pseudomonas.
(B) It drastically decreases the free water activity throughout the fresh meat tissues.
(C) It irreversibly denatures all indigenous proteolytic and lipolytic spoilage enzymes.
(D) It actively promotes the rapid growth of desirable, fermentative lactic acid bacteria.

25. Identify the correct pair regarding thermal resistance constants.
(A) Z-value - The thermal processing time required to achieve a 90% reduction in target spores.
(B) F-value - Time required at a specific temperature to achieve a desired log reduction.
(C) D-value - The temperature increase required to destroy all viable vegetative cells in 10 minutes.
(D) 12D concept - A thermal process model designed strictly for highly acidic foods (pH < 4.0).

NODIA

26. A batch of canned peas undergoes thermal processing. Post-incubation tests show spoilage with significant gas production but no pathogenic growth. The processing records indicate the required F_0 value was achieved. What is the most likely case explaining this spoilage?
(A) Post-processing container leakage leading to recontamination with pathogenic Clostridium botulinum.
(B) Survival of thermophilic spore-formers like Geobacillus stearothermophilus due to improper cooling or storage.
(C) The presence of an exceptionally high initial microbial load consisting entirely of psychrotrophic bacteria.
(D) An unusually low initial pH in the peas, which unexpectedly rendered the standard thermal processing ineffective.

27. All of the following intrinsic characteristics of a food generally increase the heat resistance of microbial spores during thermal processing, EXCEPT:
(A) High acidity (low pH)
(B) High fat content
(C) High protein concentration
(D) Low water activity

28. Which of the following statements correctly describes the Z-value in thermal processing?
(A) It is the precise duration in minutes required to kill exactly 10 spores of Clostridium botulinum.
(B) It represents the normalized, integrated lethal rate of a thermal sterilization process at 121.1°C.
(C) It is the specific change in temperature required to alter the microbial D-value by one decimal log cycle.
(D) It is a quantitative metric representing the physiological cold-shock resistance of psychrotrophic bacteria.

29. An FSO is reviewing thermal process validation data. Process A has a Z-value of 10°C and a D_{110} -value of 5 minutes. What will be the D-value at 120°C?
(A) 50 minutes
(B) 0.5 minutes
(C) 5 minutes
(D) 0.05 minutes

CHAPTER 08

Principles of Food Microbiology and Role of Microorganisms

1. Which of the following best describes the primary scope of food microbiology in the context of food safety?

(A) The biological study of food-associated microbes, focusing on spoilage and safety.

(B) The genetic study of agricultural crop mutations to enhance yield and disease resistance.

(C) The chemical analysis of essential macronutrients to determine exact nutritional profiles.

(D) The mechanical design of processing equipment to maximize thermodynamic energy efficiency.

2. Consider the following statements regarding the classification of microorganisms relevant to food:

I. Bacteria are prokaryotic organisms that reproduce primarily by binary fission.

II. Yeasts are multicellular eukaryotic fungi that reproduce via sporulation.

III. Moulds are multicellular fungi that form mycelia and are significant in both spoilage and fermentation.

IV. Viruses are obligate intracellular parasites that cannot multiply in food matrices.

Which of the statements given above are correct?

(A) I, II and III

(B) I, III and IV

(C) II, III and IV

(D) I, II and IV

3. Consider the following statements regarding protozoa in food:

Statement I: Protozoa are single-celled eukaryotic microorganisms that can be transmitted through contaminated food and water.

Statement II: Protozoa actively multiply within the food matrix during storage at room temperature.

(A) Both Statement I and Statement II are correct.

(B) Both Statement I and Statement II are incorrect.

(C) Statement I is correct but Statement II is incorrect.

(D) Statement I is incorrect but Statement II is correct.

4. Match the microorganism group in List I with its characteristic relevance to food in List II.

List I: (Microorganism group)

P. Bacteria

Q. Yeast

R. Mould

S. Virus

List II: (Relevance to food)

I. Used in single-cell protein production and leavening.

II. Cannot grow in food but often transmitted via fecal-oral route.

III. Capable of growing at extremely low water activities ($A_w < 0.80$).

IV. Highly versatile; includes lactic acid producers and major pathogens.

(A) P-IV, Q-I, R-III, S-II

(B) P-IV, Q-III, R-I, S-II

(C) P-I, Q-IV, R-II, S-III

(D) P-III, Q-I, R-IV, S-II

5. Which of the following statements regarding intrinsic factors affecting microbial growth is strictly incorrect?

(A) The outer physical structure of a food, such as fruit skin or eggshells, acts as an intrinsic barrier.

(B) Water activity measures total moisture content of food, rather than water available for microbial growth.

(C) The internal oxidation-reduction potential (Eh) dictates whether aerobic or anaerobic microbes will dominate.

(D) Naturally occurring chemical antimicrobials, such as lysozyme in egg whites, represent intrinsic factors.

Downloaded from www.pdf.tube

(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

37. What defines "mould-based fermentation" in the context of food processing?
(A) The exclusive utilization of yeasts to convert simple sugars into high concentrations of ethanol under strictly aerobic conditions.
(B) The use of filamentous fungi to enzymatically break down complex macronutrients into simpler compounds, yielding distinct textures and flavors.
(C) The biological process wherein specialized moulds strictly produce lactic and acetic acids to preserve leafy green vegetables.
(D) The uncontrolled post-harvest spoilage of bakery products and cereal grains leading to the rapid formation of hazardous mycotoxins.

38. In the production of soy sauce, koji is a critical intermediate. What is the fundamental microbiological concept behind the preparation of koji?
(A) Rapid anaerobic alcoholic fermentation of soy paste by specialized brewing strains of Saccharomyces.
(B) Continuous submerged fermentation of whole soybeans to produce high yields of pure, concentrated lactic acid.
(C) Solid-state fermentation using Aspergillus species to produce a high concentration of amylases and proteases.
(D) The targeted application of lytic bacteriophages to completely eliminate competing spoilage bacteria before fermentation.

39. Arrange the stages of traditional sauerkraut fermentation in the correct sequence of microbial dominance:
I. Lactobacillus plantarum dominates, producing high acidity.
II. Coliforms and naturally occurring epiphytic bacteria initiate fermentation.
III. Leuconostoc mesenteroides lowers pH and produces CO_2.
(A) I, II, III
(B) II, III, I
(C) III, I, II
(D) II, I, III

40. Identify the correct pair of a fermented food and its categorisation based on the primary fermentation type.
(A) Dosa - Alcoholic and lactic acid fermentation
(B) Wine - Lactic acid fermentation
(C) Pickles (traditional brined) - Mould-based fermentation
(D) Tempeh - Acetic acid fermentation

41. A traditional fermented beverage is prepared using malted barley. During fermentation, the brewer notices a severe off-odour resembling butter or butterscotch. What is the most likely case for this defect in beer?
(A) Excessive over-production of ethanol and volatile higher alcohols by wild yeast strains.
(B) Contamination with Pediococcus or mutant yeast leading to excessive diacetyl production.
(C) Complete, premature breakdown of complex starches by fungal enzymes from Aspergillus oryzae.
(D) Rapid biochemical oxidation of hot wort lipids and proteins prior to active yeast pitching.

42. All of the following are traditional Indian fermented foods, EXCEPT:
(A) Dhokla
(B) Kombucha
(C) Bhatura
(D) Appam

43. Which of the following statements is correct regarding the role of microbes in idli and dosa fermentation?
(A) Leuconostoc mesenteroides is primarily responsible for leavening the batter.
(B) Fermentation decreases the bioavailability of B-vitamins in the batter.
(C) Only yeasts are involved; bacteria play no role in traditional idli fermentation.
(D) The batter must be sterilized prior to natural fermentation.

NODIA

44. As an inspector, you are reviewing the fermentation parameters of a commercial wine facility. To ensure the optimal functioning of Saccharomyces cerevisiae and prevent stuck fermentation, which extrinsic factor requires the most precise competency to monitor?
(A) Ensuring continuous 100% dissolved oxygen saturation throughout the entire primary

inactive. Phage testing confirms the presence of lytic bacteriophages. This is a case of:
(A) Widespread spoilage and gas production by coliforms
(B) Endogenous enzymatic degradation of raw milk proteins
(C) Excessive over-production of lactic acid by wild flora
(D) Starter culture failure due to lytic viral infection

87. All of the following are typically considered primary products of heterofermentative lactic acid bacteria EXCEPT:
(A) Butyric acid
(B) Lactic acid
(C) Ethanol
(D) Carbon dioxide

88. Which of the following statements correctly describes traditional Indian 'Kinema'?
(A) It is an acidic fermented milk product made using traditional strains of Saccharomyces.
(B) It is an alkaline fermented soybean product primarily utilizing specialized Bacillus subtilis strains.
(C) It is a commercial type of vegetable pickle fermented strictly by heterofermentative lactic acid bacteria.
(D) It is a high-fat fermented meat sausage traditionally prepared throughout the Northeast Indian region.

89. A food technologist is troubleshooting a cloudy appearance in bottled clear apple juice stored at room temperature. The juice has a pH of 3.5. What competency is required to identify the most probable spoilage organisms?
(A) Recognizing that at a low pH of 3.5, pathogenic anaerobic Clostridium species will act as the dominant spoilers.
(B) Knowing that aciduric yeasts (e.g., Zygosaccharomyces) or moulds are the most likely survivors and spoilers at this pH.
(C) Identifying that psychrotrophic Pseudomonas strains thrive exceptionally well in acidic, ambient storage conditions.
(D) Deducing that heat-resistant bacterial endospores of the genus Bacillus have successfully germinated in the juice.

90. Which of the following is the BEST description of the term "D-value"?
(A) The time required in minutes at a given temperature to destroy 90% of the target microorganism.
(B) The processing time required to completely and absolutely eliminate a viable microbial population.
(C) The specific temperature required to decrease the total thermal death time by a decimal factor of 10.
(D) The quantitative measure of a target foodborne microorganism's physiological resistance to acidic pH.

91. Which phase of the microbial growth curve is characterized by the accumulation of toxic waste products and depletion of nutrients, leading to equal rates of cell division and cell death?
(A) Lag phase
(B) Logarithmic phase
(C) Stationary phase
(D) Death phase

92. Consider the following statements regarding the thermal death time (TDT) concept:
I. TDT is the time required to kill a specific number of microorganisms at a specific temperature.
II. As the processing temperature increases, the TDT increases.
III. TDT data is essential for establishing safe canning processes.
IV. TDT is plotted on a semi-logarithmic graph to determine the Z-value.
Which of the statements given above are correct?
(A) I, II and III
(B) I, III and IV
(C) II, III and IV
(D) I, II, III and IV

93. Consider the following statements regarding the spoilage of meat:
Statement I: Off-odours in spoiled meat are primarily due to the breakdown of carbohydrates into organic acids.
Statement II: The degradation of amino acids in meat yields volatile compounds like ammonia, hydrogen sulfide, and putrescine.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.

Click Here to Buy book on Amazon

correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

52. What distinguishes enzymatic spoilage from microbial spoilage?
(A) Enzymatic spoilage involves external environmental agents synthesizing enzymes, whereas microbial spoilage utilizes only endogenous plant or animal enzymes.
(B) Enzymatic spoilage occurs exclusively in hermetically sealed canned foods, whereas microbial spoilage is restricted solely to open fresh agricultural produce.
(C) Enzymatic spoilage consistently results in significant carbon dioxide and hydrogen gas production, which is rarely observed in typical microbial spoilage.
(D) Enzymatic spoilage is caused by intrinsic food enzymes degrading tissue, while microbial spoilage relies on enzymes secreted by actively proliferating microbes.

53. A food safety officer investigates a batch of vacuum-packed frankfurters that exhibit a distinct green discolouration and a sour odour, despite refrigeration. What microbial concept best explains this?
(A) Oxidative chemical rancidity catalyzed by endogenous lipoxygenase enzymes during long storage.
(B) Growth of psychrotrophic, microaerophilic lactic acid bacteria like Weissella or Leuconostoc producing hydrogen peroxide.
(C) Accelerated non-enzymatic Maillard browning reactions catalyzed by residual amino acids and sugars at low storage temperatures.
(D) Rapid aerobic proliferation of psychrotrophic Pseudomonas species forming a thick fluorescent biofilm on the outer packaging.

54. The metabolic breakdown of proteins during food spoilage results in the production of foul-smelling compounds. This specific process is termed:
(A) Saccharification
(B) Fermentation
(C) Putrefaction
(D) Caramelisation

55. Identify the correct pair of a spoilage microorganism and its typical metabolic spoilage product.
(A) Highly active Pseudomonas fragi synthesizing ethyl alcohol in fresh red meat
(B) Clostridium tyrobutyricum causing slime formation in raw leafy vegetables
(C) Erwinia carotovora producing high concentration of lactic acid in lager beer
(D) Zygosaccharomyces bailii generating carbon dioxide gas and turbidity in fruit juices

56. In a vegetable storage warehouse, a rapid spread of soft rot is observed among carrots. The tissues are reduced to a mushy, foul-smelling mass. Which of the following is the most likely case?
(A) Pectinolytic enzymes secreted by Erwinia carotovora (now Pectobacterium).
(B) Carcinogenic aflatoxin production and mycelial growth by Aspergillus flavus.
(C) Extracellular lipase and enterotoxin activity by Staphylococcus aureus.
(D) Spontaneous, high-rate alcoholic fermentation by contaminating wild yeasts.

57. All of the following are common indicators of microbial food spoilage EXCEPT:
(A) Formation of slime on the food surface
(B) Increase in total soluble solids (Brix) in fruit juices
(C) Evolution of carbon dioxide or hydrogen sulfide gas
(D) Uncharacteristic colour changes or pigment formation

58. Which of the following statements correctly highlights the economic significance of food spoilage?
(A) It positively impacts the economy by increasing the demand for fresh agricultural produce.
(B) It causes massive financial losses globally across the supply chain, from harvest to retail.
(C) Economic losses are isolated entirely to the consumer end of the supply chain.
(D) Microbial spoilage increases the market value of staple grains due to weight gain from moisture.

59. When assessing the shelf-life of a newly formulated, mildly heated, ready-to-eat dairy dessert, an FSO must apply hurdle technology

Downloaded from www.pdf.tube

production by the starter culture Streptococcus thermophilus
(C) Exopolysaccharide (capsule) production by bacteria such as Alcaligenes viscolactis or certain LAB
(D) Hydrolytic lipase degradation of complex milk fats by psychrotrophic strains of Pseudomonas species

102. All of the following are intrinsic parameters that influence microbial growth EXCEPT:
(A) Inherent biological barrier structures of food
(B) Total nutrient content and chemical composition
(C) Internal oxidation-reduction potential (Eh)
(D) Storage atmosphere composition and gas concentration

103. Which of the following statements correctly identifies the function of Z-value?
(A) It determines the relative resistance of a microorganism to different lethal temperatures.
(B) It quantitatively evaluates the kinetic rate of non-enzymatic chemical food spoilage over time.
(C) It mathematically predicts the exact, absolute shelf-life of a packaged product in storage days.
(D) It directly measures the active concentration of naturally occurring antimicrobial agents in food.

104. An FSO is assessing the risk of Staphylococcus aureus enterotoxin production in a bakery producing cream-filled pastries. Which competency is essential to evaluate the control measures?
(A) Understanding that the enterotoxin is highly heat labile and can be easily destroyed by standard home reheating.
(B) Knowing that *S.* aureus can grow at relatively low a_w (up to 0.86) and its pre-formed toxin is heat-stable.
(C) Identifying that the bacteria are strictly obligate anaerobes and thus completely incapable of growing in pastries.
(D) Verifying that blast freezing the finished pastries immediately and irreversibly destroys any pre-formed toxin.

105. Identify the incorrect pair regarding spoilage indicators and their underlying chemical cause.
(A) Rancidity - Oxidation or hydrolysis of lipids
(B) Putrefaction - Fermentation of complex carbohydrates
(C) Sourness - Accumulation of organic acids like lactic or acetic acid
(D) Swelling of cans - Evolution of CO_2 or H_2 gas

106. Which of the following microorganisms is considered a classical indicator of fecal contamination in water and food?
(A) Escherichia coli
(B) Lactobacillus casei
(C) Saccharomyces cerevisiae
(D) Aspergillus niger

107. Consider the following statements about microbial spoilage of meat:
I. Fresh meat stored aerobically at chilling temperatures is predominantly spoiled by psychrotrophic Pseudomonas species.
II. Anaerobic storage (vacuum packaging) shifts the spoilage microflora towards lactic acid bacteria.
III. Bone taint in deep meat tissues is usually caused by aerobic moulds.
IV. High fat content makes meat entirely immune to microbial spoilage.
Which of the statements given above are correct?
(A) I and II only
(B) I, II and III
(C) II and IV only
(D) I, III and IV

NODIA

108. Consider the following statements regarding the log phase of microbial growth:
Statement I: The log phase of microbial growth is mathematically described by exponential equations.
Statement II: The specific growth rate during the log phase is independent of the environmental temperature.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

109. Match the microbial spoilage term in List I with its description in List II.
List I: (Term)

mathematically predict shelf-life at normal storage conditions.
(D) Predictive microbiology uses mathematical models to predict the growth or decline of microorganisms in food.

66. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Arrhenius equation is widely used in Accelerated Shelf-Life Testing (ASLT) of foods.
Reason (R): The Arrhenius equation models the temperature dependence of chemical reaction rates, allowing prediction of deterioration rates at lower temperatures.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

67. What is the definition of "Commercial Sterility" as applied to canned foods?
(A) The condition achieved by application of heat which renders the food free of microorganisms capable of reproducing in the food under normal non-refrigerated conditions of storage.
(B) The absolute and complete thermal destruction of all living vegetative cells, bacterial endospores, and highly heat-resistant hyperthermophilic organisms within the processed food matrix.
(C) The selective biological elimination of all pathogenic vegetative bacteria from the food matrix, while intentionally allowing common environmental spoilage yeasts and moulds to remain viable.
(D) The mechanical process of achieving and maintaining an internal core food temperature of exactly 100°C for a continuous thermal holding time of at least 5.0 minutes during processing.

68. If a food product relies on a low pH to maintain its shelf life, and buffering agents are accidentally omitted during manufacturing causing the pH to rise, what is the core concept applied to predict the outcome?
(A) A significant chemical lowering of the activation energy required for rapid enzymatic browning.
(B) A progressive decrease in the standard F_0 value safety requirement during thermal pasteurization.
(C) The complete physiological inhibition of putrefactive anaerobic bacteria due to highly alkaline conditions.
(D) Shift in the implicit factors allowing less acid-tolerant pathogens like Salmonella to proliferate.

69. Arrange the typical stages of shelf-life determination via Challenge Testing in the correct sequence:
I. Inoculation of the product with a known concentration of the target microorganism.
II. Storage of the product under controlled environmental conditions.
III. Formulation and initial production of the test food batch.
IV. Periodic sampling and enumeration of the target microorganism.
(A) III, I, II, IV
(B) I, III, II, IV
(C) III, II, I, IV
(D) I, II, IV, III

70. Identify the correct pair linking a shelf-life testing method with its application.
(A) Direct (Real-time) testing - Storing products at 50°C to simulate 1 year of shelf-life in 1 month.
(B) Predictive modelling - Using sensory panels exclusively to determine expiration dates.
(C) Challenge testing - Artificially contaminating food to assess the viability of pathogens over time.
(D) ASLT - Relying solely on historical sales data to predict spoilage.

71. A commercial bakery formulates a new moisture-rich cake. After 4 days at room temperature, white and green patches appear on the surface. Laboratory analysis confirms multicellular eukaryotes with septate hyphae. This case is a classic example of:
(A) Bacterial putrefaction
(B) Yeast fermentation
(C) Chemical oxidation
(D) Mould spoilage

72. All of the following are intrinsic factors utilized in Hurdles Technology to extend shelf life EXCEPT:

Click Here to Buy book on Amazon

principles. Which combination optimally delays microbial spoilage without severe thermal degradation?
(A) Decreasing pH, adding potassium sorbate, and storing at 4°C.
(B) Raising pH to 8.0, storing at 35°C, and vacuum packaging.
(C) Increasing water activity to 0.99 and adding amylases.
(D) Storing under strictly aerobic conditions at 25°C.

60. Which is the most appropriate primary indicator used to assess the microbial spoilage of fresh marine fish stored on ice?
(A) The continuous progressive accumulation of metabolic lactic acid
(B) A substantial enzymatic increase in free reducing hexose sugars
(C) Production of Trimethylamine (TMA) and volatile basic nitrogen (VBN)
(D) A significant technological reduction of internal water activity

61. Which of the following describes the "D-value" in thermal processing?
(A) The specific processing temperature required to destroy a defined population of vegetative pathogens in exactly 1.0 minute.
(B) The total integrated holding time at a specific retort temperature required to render a packaged food commercially sterile.
(C) The precise temperature difference required to produce a ten-fold (one decimal log cycle) change in the thermal death time.
(D) The processing time in minutes required to achieve a 1-log (90%) reduction in a target microbial population at a constant temperature.

62. Consider the following factors influencing the rate of food spoilage:
I. The initial microbial load (bioburden) on the raw materials.
II. The integrity of the physical barriers (e.g., eggshells, fruit skins).
III. The application of the cold chain during transport.
IV. The aesthetic design of the outer cardboard packaging.
Which of the statements given above are correct?
(A) I, II and IV
(B) I, II and III
(C) II, III and IV
(D) I, III and IV

63. Consider the following statements regarding chemical spoilage of foods:
Statement I: Chemical spoilage such as oxidative rancidity in fats is directly caused by the metabolic activity of bacteria.
Statement II: Chemical spoilage occurs via reactions like autoxidation of lipids, which can be accelerated by light, heat, and trace metals.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

64. Match the control measure in List I with its primary mechanism of preventing spoilage in List II.
List I: (Control measure)
P. Pasteurization
Q. Freezing
R. Modified Atmosphere Packaging (MAP)
S. Addition of Sodium Nitrite
List II: (Mechanism)
I. Inhibits the germination of Clostridium spores in cured meats.
II. Lowers available water (forming ice crystals) and halts cellular metabolism.
III. Destroys vegetative pathogenic and spoilage microbes using mild heat.
IV. Alters the gaseous environment to inhibit aerobic respiration.
(A) P-III, Q-II, R-IV, S-I
(B) P-III, Q-IV, R-II, S-I
(C) P-II, Q-III, R-I, S-IV
(D) P-IV, Q-II, R-III, S-I

65. Which of the following statements about shelf-life determination is incorrect?
(A) Challenge testing involves determining the nutritional profile of the food after varying periods.
(B) Shelf-life is the time period under defined conditions during which a food product remains safe and retains desired sensory, chemical, and physical characteristics.
(C) Accelerated Shelf-Life Testing (ASLT) utilizes elevated temperatures to

NODIA

List I: (Thermal processing objective)
P. Low-acid canned food commercial sterility
Q. Milk pasteurization (HTST)
R. High-acid food hot-fill process
S. Beer pasteurization
List II: (Target microorganism)
I. Coxiella burnetii
II. Clostridium botulinum
III. Spoilage yeasts and lactobacilli
IV. Lactobacillus and spoilage moulds
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-I, R-III, S-IV
(D) P-IV, Q-III, R-II, S-I

80. Which of the following statements regarding the role of implicit factors is incorrect?
(A) Implicit factors refer to the technological interventions (like irradiation) applied by food processors.
(B) Specific growth rate of an organism dictates how quickly a microbe can outcompete others in a food matrix.
(C) Synergism occurs when the active metabolic growth of one microbe creates highly favourable conditions for another.
(D) The physiological production of antimicrobial bacteriocins by LAB is a classic example of implicit antagonism.

81. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Salmonella cannot multiply in commercially produced mayonnaise.
Reason (R): Commercially produced mayonnaise is acidified with vinegar to a pH below 4.1, which is lethal or inhibitory to Salmonella.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

82. In food microbiology, what is the exact definition of "Generation Time"?
(A) The time required for a microbial population to double in number during the log phase.
(B) The total metabolic time it takes for a dormant bacterial endospore to fully germinate.
(C) The absolute chronological duration of the stationary phase before cell death begins.
(D) The thermal processing time required to completely eliminate a microbial population.

83. When analyzing the microbial growth curve, if a food preservative is added that strictly operates as a bacteriostatic agent, what is the conceptual outcome on the curve?
(A) The active population curve immediately plunges into a highly rapid decline and death phase.
(B) The exponential log phase generation time remains completely unchanged despite the additive.
(C) The final stationary phase viable cell density dramatically increases over the storage period.
(D) The lag phase is vastly extended, or active growth halts without causing immediate cell death.

84. What is the cause-effect relationship of applying hurdle technology in ready-to-eat meats using vacuum packaging (low O_2), salt addition (lower a_w), and refrigeration (low temperature)?
(A) It causes the absolute and immediate commercial sterilization of the meat, completely preventing spoilage.
(B) It causes synergistic inhibition of vegetative pathogens and spoilage flora, effectively extending shelf-life.
(C) It causes the rapid and uncontrolled proliferation of aerobic surface moulds due to competitive exclusion.
(D) It causes a significant increase in the final post-mortem meat pH, thereby enhancing sensory qualities.

85. Identify the correct pair of a fermented Indian food and its defining microbiological characteristic.
(A) Jalebi batter - Exclusively fermented by moulds
(B) Shrikhand - Alcoholic fermentation of milk
(C) Kanji - Lactic acid fermentation of black carrots
(D) Kinema - Acetic acid fermentation of soybeans

86. A dairy produces cheddar cheese. During a specific batch, the curd fails to acidify sufficiently within the expected timeframe. Laboratory tests show that the starter culture is viable but

Downloaded from www.pdf.tube

fermentation.
(B) Keeping the ambient relative humidity of the fermentation cellar strictly below a threshold of 30%.
(C) Maintaining the fermentation temperature within the specific yeast strain's optimal range of 15-25°C.
(D) Ensuring continuous germicidal ultraviolet (UV) irradiation of the internal fermentation tanks.

45. Identify the incorrect pair regarding microorganisms and fermented products.
(A) Acetobacter aceti - Vinegar
(B) Saccharomyces ellipsoideus - Wine
(C) Aspergillus oryzae - Koji
(D) Streptococcus thermophilus - Beer

46. How is "food spoilage" generally defined in food science?
(A) The intentional alteration of physicochemical food properties using characterized beneficial starter cultures.
(B) The technological sterilization process of reducing the baseline microbial load of a food matrix to absolute zero.
(C) Any change in food that renders it unacceptable for human consumption due to sensory, physical, or chemical defects.
(D) The structural physical damage caused to consumer-facing food packaging during long-distance road transport.

47. Consider the following statements about microbial spoilage of grains:
I. Grains stored at high moisture content ($A_w > 0.85$) are highly susceptible to mould spoilage.
II. Storage fungi of grains primarily belong to the genera Aspergillus and Penicillium.
III. Microbial spoilage of grains never results in chemical toxicity.
IV. Field fungi such as Fusarium infect grains before harvest.
Which of the statements given above are correct?
(A) I, II and IV
(B) I, II and III
(C) II, III and IV
(D) I, III and IV

48. Consider the following statements regarding food spoilage susceptibility:
Statement I: Fruits are generally more susceptible to bacterial spoilage than moulds.
Statement II: The inherently low pH of most fruits inhibits bacterial growth, allowing acid-tolerant moulds to dominate spoilage.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

NODIA

49. Match the type of spoilage in List I with its classic indicator in List II.
List I: (Spoilage type)
P. Proteolysis in meat
Q. Lipolysis in butter
R. Carbohydrate fermentation in juices
S. Slime formation on vegetables
List II: (Indicator)
I. Rancid off-odours (free fatty acids)
II. Putrid odours (H_2S, amines)
III. Extracellular polysaccharide capsule production
IV. Souring and vigorous gas production
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-I, R-III, S-IV
(D) P-IV, Q-III, R-II, S-I

50. Which of the following statements about dairy spoilage is incorrect?
(A) Psychrotrophic bacteria like Pseudomonas species are major spoilers of pasteurized milk kept under refrigeration.
(B) "Bitty cream" defect is caused by the proteolytic activity of Bacillus cereus.
(C) Raw milk spoils initially through putrefaction because lactic acid bacteria are absent.
(D) Souring of raw milk is typically driven by lactose-fermenting bacteria.

51. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Meat is an excellent substrate for the rapid proliferation of spoilage microorganisms.
Reason (R): Meat provides abundant nutrients, a high water activity (> 0.98), and a favorable pH (around 5.5-6.5) for bacterial growth.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the

(D) Statement I is incorrect but Statement II is correct.

94. Match the traditional Indian fermented food in List I with its primary substrate in List II.
List I: (Fermented food)
P. Dosa
Q. Gundruk
R. Rabdi (fermented)
S. Toddy
List II: (Substrate)
I. Pearl millet / buttermilk
II. Leafy vegetables (mustard/radish)
III. Rice and black gram
IV. Palm sap
(A) P-III, Q-II, R-I, S-IV
(B) P-III, Q-I, R-II, S-IV
(C) P-II, Q-III, R-I, S-IV
(D) P-I, Q-II, R-III, S-IV

95. Which of the following statements about yeasts is incorrect?
(A) Saccharomyces cerevisiae is heavily utilized in baking and brewing.
(B) Yeasts prefer slightly acidic conditions (pH 4.0-4.5) for optimal growth.
(C) Yeasts generally require a higher water activity than moulds to grow.
(D) Yeasts are strictly obligate anaerobes.

96. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Refrigeration of fresh produce halts the growth of all microorganisms, preventing spoilage indefinitely.
Reason (R): Low temperatures downregulate microbial enzyme kinetics, slowing down metabolism.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

97. What is the definition of an "antimicrobial" in the context of intrinsic food factors?
(A) Any synthetic chemical compound or polymer actively added to the food packaging materials during production.
(B) Non-thermal physical processes such as ultraviolet irradiation that completely destroy vegetative bacteria.
(C) Naturally occurring chemical substances within the food matrix that exhibit bacteriostatic or bactericidal properties.
(D) Specific competitive environmental microorganisms that actively and rapidly spoil high-moisture fresh foods.

98. A food plant uses an integrated lethality calculation to validate a new pasteurization process. The concept dictates that the total lethality (F-value) is an accumulation of lethal rates. This mathematical integration primarily relies on the continuous measurement of which parameter inside the product?
(A) Core temperature over time
(B) pH
(C) Available water content
(D) Oxidation-reduction potential

99. Arrange the following microorganisms in descending order of their general tolerance to low water activity (a_w) (from most tolerant to least tolerant):
I. Xerophilic moulds
II. Most Gram-negative bacteria
III. Osmophilic yeasts
IV. Most Gram-positive bacteria
(A) I, III, IV, II
(B) II, IV, III, I
(C) III, I, IV, II
(D) I, II, III, IV

100. Identify the correct pair of a viral hazard and its primary route of transmission in food systems.
(A) Norovirus - Spore germination in undercooked meat
(B) Hepatitis A - Fecal-oral route via contaminated water/food handlers
(C) Rotavirus - Proliferation in temperature-abused dairy products
(D) Bacteriophage - Consumption of unwashed raw vegetables causing human gastroenteritis

101. In a case where a Food Safety Officer receives complaints of "ropy" or stringy milk from consumers purchasing a local brand of pasteurized milk, and the milk forms viscous threads when poured, what is the most likely microbial cause of this spoilage defect?
(A) High-rate extracellular protease enzyme production by contaminating strains of Bacillus subtilis
(B) Rapid fermentation and organic acid

Click Here to Buy book on Amazon

(A) Relative humidity
(B) Titratable acidity
(C) Redox potential
(D) Competitive flora (implicit/intrinsic biological structures)

73. Which of the following statements regarding the control measures to prevent food spoilage is correct?
(A) High-Temperature Short-Time (HTST) pasteurization is designed to achieve absolute commercial sterility in canned leguminous beans.
(B) Food irradiation utilizing Gamma rays relies on ionizing energy to irreversibly damage microbial DNA, thereby controlling spoilage.
(C) Freezing process completely kills 100% of the baseline vegetative bacterial population, preventing any subsequent activity upon thawing.
(D) Chemical food preservatives like sulfites are completely ineffective against common spoilage yeasts and acid-tolerant moulds.

74. An FSO reviews a manufacturer's shelf-life protocol for a ready-to-eat salad. The manufacturer only tests for generic Coliforms on day 1 and sets a 14-day shelf-life. What is the critical competency failure in this assessment?
(A) Coliforms and related enteric pathogens represent the only microbiological species that are biochemically capable of causing fresh salad spoilage.
(B) The protocol lacks end-of-shelf-life testing and fails to monitor psychrotrophic spoilage flora or pathogens like Listeria monocytogenes.
(C) Industrial ready-to-eat packaged salads do not require active microbiological shelf-life testing because they are formulated to be intrinsically safe.
(D) A negative coliform test on Day 1 biochemically guarantees total microbial stability and pathogen safety up to the end of the 14-day storage period.

75. Identify the incorrect pair regarding control measures and their targeted parameter.
(A) Homogenization - Destroys bacterial endospores
(B) Dehydration - Lowers water activity (a_w)
(C) Vacuum packaging - Reduces available Oxygen
(D) Blanching - Inactivates endogenous food enzymes

76. What is the fundamental basis for classifying microbes as beneficial in food microbiology?
(A) They rapidly degrade fragile food chemical matrices, which directly leads to highly shortened retail shelf-lives.
(B) They naturally synthesize protective toxins that effectively prevent the human consumption of heavily spoiled foods.
(C) They are utilized in processes like fermentation to improve flavour, texture, preservation, and nutritional value.
(D) They are solely and exclusively utilized for the automated bio-remediation of liquid food processing plant waste.

NODIA

77. Consider the following statements regarding lactic acid bacteria (LAB):
I. They are Gram-positive, non-spore-forming bacteria.
II. They are obligate aerobes requiring high oxygen levels.
III. They lower the pH of the food matrix, inhibiting pathogenic bacteria.
IV. They are naturally found in raw milk and on plant surfaces.
Which of the statements given above are correct?
(A) I, II and III
(B) I, III and IV
(C) II, III and IV
(D) I, II and IV

78. Consider the following statements regarding thermal processing parameters:
Statement I: The Z-value denotes the time required in minutes to destroy a specific microorganism at 121.1°C.
Statement II: The F-value denotes the temperature required to achieve a 1-log reduction in a microbial population.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

79. Match the specific thermal processing objective in List I with its target microorganism in List II.

P. Flat sour spoilage
Q. Thermophilic anaerobic spoilage
R. Sulfide stinker spoilage
S. Putrefactive anaerobic spoilage

List II: (Description)

I. Causes swelling of cans with a cheesy/putrid odour.
II. Characterized by blackening of food and "rotten egg" odour without gas swelling.
III. Produces acid but no gas; the can remains flat.
IV. Produces abundant gas, swelling cans, often with a sour odour, no blackening.

(A) P-III, Q-IV, R-II, S-I
(B) P-IV, Q-III, R-I, S-II
(C) P-III, Q-II, R-IV, S-I
(D) P-I, Q-IV, R-II, S-III

110. Which of the following statements about hurdle technology is incorrect?
(A) It relies on the synergistic effect of multiple sub-lethal preservation methods.
(B) It dictates that every hurdle applied must individually be lethal enough to sterilize the food.
(C) It aims to improve the sensory quality of food by avoiding severe single preservation treatments.
(D) It works by disturbing microbial homeostasis (e.g., internal pH, ATP levels).

111. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Aspergillus flavus growth on stored peanuts is a major food safety hazard.
Reason (R): Aspergillus flavus produces aflatoxins, which are highly hepatotoxic and carcinogenic secondary metabolites.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

112. What defines "fermentation" in a biochemical and food science context?
(A) The breakdown of organic substances by microorganisms to produce energy, typically under anaerobic conditions, yielding products like organic acids or alcohol.
(B) The complete biochemical aerobic oxidation of glucose molecules into carbon dioxide and water to maximize cellular adenosine triphosphate production.
(C) The purely chemical and enzymatic, non-microbial oxidative browning of specialized agricultural plant tissues when exposed to atmospheric oxygen.
(D) The mechanical and physical separation of curd solids from liquid whey using commercial rennet enzymes during standard cheese manufacturing.

113. If an intrinsically low-acid food (pH 6.5) is formulated with a water activity of 0.88 and packaged in a high-oxygen environment, what is the conceptual prediction regarding its most likely spoilage microflora at room temperature?
(A) Rapid putrefaction and lethal neurotoxin production by anaerobic Clostridium botulinum.
(B) Severe, rapid alcoholic fermentation by highly sugar-tolerant osmotolerant baking yeasts.
(C) Spoilage driven predominantly by salt-tolerant Staphylococcus aureus and aerobic moulds.
(D) Lactic acid souring and gas production by strictly anaerobic heterofermentative bacteria.

NODIA

114. What is the primary cause-effect relationship of applying lysozyme in the production of certain ripened cheeses?
(A) It degrades the peptidoglycan cell wall of Gram-positive bacteria, preventing late-blowing defect caused by Clostridium tyrobutyricum.
(B) It causes the rapid biochemical breakdown of milk fat globules, effecting intense, sharp lipolytic flavours during cheese aging.
(C) It coagulates milk casein micelles via targeted proteolysis, directly effecting the primary structural curd during manufacturing.
(D) It completely inhibits all beneficial lactic acid starter bacteria, effecting a total halt in acid development and fermentation.

115. Identify the correct pair of a fermented food and the specific microbial species critical to its unique profile.
(A) Sauerkraut - Saccharomyces cerevisiae
(B) Soy sauce - Penicillium camemberti
(C) Wine - Streptococcus thermophilus
(D) Swiss cheese - Propionibacterium

145. Identify the correct pair regarding the phases of microbial growth and its description.
(A) Lag phase - Maximum rate of cell division
(B) Stationary phase - Cells are entirely dormant and resistant to all heat
(C) Log phase - Exponential growth and active metabolism
(D) Death phase - Sporulation strictly ends and cells rejuvenate

146. In a case where a batch of wine exhibits a vinegar-like taint after being left in unsealed barrels, and microbiological analysis shows rod-shaped bacteria forming a pellicle on the surface, what is the primary microbial phenomenon occurring?
(A) Accidental contamination and aerobic growth of Acetobacter converting valuable ethanol into sour acetic acid.
(B) Spontaneous secondary malolactic fermentation carried out by acidophilic dairy strains of Oenococcus oeni.
(C) Severe operational over-pitching of active starter Saccharomyces cerevisiae leading to rapid cellular autolysis.
(D) Anaerobic putrefaction and proteolytic degradation of complex grape proteins by contamination with Clostridium.

147. All of the following are examples of extrinsic parameters used to control microbial growth, EXCEPT:
(A) Lowering the temperature in a cold storage room.
(B) Decreasing the relative humidity in a dry-goods warehouse.
(C) Flushing packaging with a mixture of Nitrogen and Carbon Dioxide.
(D) Modifying the food formulation to contain 10% salt.

148. Which of the following statements about protozoa in food is correct?
(A) Protozoa can rapidly divide by binary fission and form highly visible multi-cellular colonies on the surface of raw meat.
(B) Protozoa like Cryptosporidium and Giardia are primarily transmitted via contaminated water and poor food handler hygiene.
(C) All eukaryotic protozoa are immediately and completely destroyed upon contact with mild food-grade organic acids (pH 6.0).
(D) Protozoa are the primary biological organisms directly responsible for the biochemical fermentation of liquid dairy products.

149. An FSO audits a facility producing ready-to-eat sandwiches. The facility claims a 30-day shelf-life based purely on mathematical models without historical data or actual lab testing. What competency guides the FSO's corrective action?
(A) Mathematical computer models based on predictive microbiology are considered absolute and never require any wet laboratory validation.
(B) Ready-to-eat sandwiches possess an inherent, scientifically validated 30-day shelf life by definition, regardless of storage conditions.
(C) Predictive models provide estimates; actual challenge testing and real-time shelf-life studies must validate the 30-day claim for RTE products.
(D) Product shelf-life is strictly and legally determined by the raw packaging film manufacturer, rather than the primary food producer.

150. Which of the following is the BEST approach to accurately determine the absolute expiration date of a new, highly perishable dairy beverage?
(A) Mathematically modeling the product degradation using the Arrhenius equation based on raw data collected at a single elevated temperature.
(B) Relying solely on historically published scientific literature and technical sheets regarding generic pasteurized milk spoilage patterns.
(C) Extrapolating the absolute finished product shelf life directly from the thermal inactivation D-value of its most heat-sensitive enzyme.
(D) Conducting real-time shelf-life testing coupled with active microbiological challenge studies under realistic environmental storage conditions.

www.nodia.in

Downloaded from www.pdf.tube

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

124. Match the extrinsic factor in List I with its direct effect on microorganisms in List II.
List I: (Extrinsic factor)
P. Freezing temperatures
Q. Modified Atmosphere (High CO_2)
R. High Relative Humidity
S. Thermal processing (Heat)
List II: (Effect)
I. Promotes hydration and surface growth of moulds.
II. Denatures essential proteins and nucleic acids.
III. Halts enzymatic activity and creates intracellular ice crystals.
IV. Extends the lag phase of aerobic spoilage bacteria.
(A) P-III, Q-IV, R-I, S-II
(B) P-III, Q-I, R-IV, S-II
(C) P-II, Q-IV, R-I, S-III
(D) P-IV, Q-III, R-II, S-I

125. Which of the following statements about microbial indicators of spoilage is strictly incorrect?
(A) Slime formation on meat surfaces is typically caused by the accumulation of bacterial cells and their exopolysaccharides.
(B) Gas production in cheeses can lead to a defect known as "early blowing" which is typically caused by active coliforms.
(C) Discolouration in fresh meat, such as a shift from red to brown, is always purely a microbial process and never a chemical autoxidation.
(D) The generation of off-odours like putrescine and cadaverine indicates advanced, post-mortem proteolytic protein degradation.

126. Given below are an Assertion (A) and a Reason (R).
Assertion (A): The use of nitrate/nitrite in cured meats is crucial for preventing botulism.
Reason (R): Nitrite strongly inhibits the outgrowth of Clostridium botulinum spores and the formation of botulinum toxin.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

127. In the context of intrinsic factors, what does the term "a_w" precisely define?
(A) The simple absolute percentage of total moisture or water by weight within a finished food product.
(B) The total physical amount of water chemically bound to internal food proteins and complex carbohydrates.
(C) The kinetic rate at which free water continuously evaporates from a food surface under dry conditions.
(D) The ratio of the water vapour pressure of the food to the vapour pressure of pure water at the same temperature.

128. A food processor wants to formulate a shelf-stable mayonnaise. If the formula relies on a synergistic interaction between acetic acid (vinegar) and salt, which specific concept governs the inhibition of microbes here?
(A) The Hurdle Effect
(B) Thermal destruction kinetics
(C) Competitive exclusion
(D) Biomagnification

129. Arrange the following steps in the sequence of assessing shelf-life using a Predictive Microbiology approach:
I. Validate the model using real food matrices.
II. Identify the primary spoilage or pathogenic microorganism of concern.
III. Use mathematical models to predict growth based on food parameters (pH, a_w, Temp).
IV. Gather specific product formulation data (intrinsic and extrinsic factors).
(A) II, IV, III, I
(B) IV, II, I, III
(C) II, III, IV, I
(D) I, II, III, IV

NODIA

130. Identify the correct pair of a fermented product and its primary defining microorganism.
(A) Koji - Aspergillus oryzae
(B) Idli - Saccharomyces cerevisiae
(C) Kombucha - Lactobacillus bulgaricus

(D) Pickle - Rhizopus stolonifer

131. In a case where an outbreak of foodborne illness is traced back to a batch of improperly fermented traditional sausages with a final pH of 5.8 instead of the target 4.8, what is the most likely consequence of this elevated pH?
(A) The elevated pH allowed the rapid and unchecked cellular proliferation of highly acid-tolerant yeasts and moulds.
(B) The high pH caused rapid, irreversible denaturation of muscle myofibrillar proteins leading to structural collapse.
(C) The sausages became biochemically excessively sour, highly acidic, and completely unpalatable to consumers.
(D) The elevated pH failed to inhibit the growth of pathogenic bacteria such as Staphylococcus aureus or Salmonella.

132. All of the following are examples of lactic acid fermented foods EXCEPT:
(A) Yogurt (Curd)
(B) Beer
(C) Sauerkraut
(D) Kimchi

133. Which of the following statements correctly describes the death phase in a microbial growth curve?
(A) The total net number of viable, actively metabolic vegetative cells remains completely constant in the matrix.
(B) Bacterial endospores paradoxically become highly vulnerable to physical and thermal destruction during this phase.
(C) The biochemical rate of cellular death is highly exponential and significantly exceeds the rate of cell division.
(D) The ambient nutrient concentration within the closed food matrix abruptly reaches its maximum structural level.

134. An FSO observes that fresh-cut fruits stored at 5°C in a retail display are browning rapidly without any signs of softening, gas, or off-odour. The FSO correctly deduces that this is primarily:
(A) Microbial spoilage caused by psychrotrophic, pigment-producing bacteria.
(B) Chemical spoilage caused by non-enzymatic oxidative Maillard reactions.
(C) Fungal spoilage by plant-pathogenic strains of Penicillium expansum.
(D) Enzymatic spoilage driven by endogenous polyphenol oxidase (PPO) activity.

135. Identify the incorrect pair regarding intrinsic food factors and microbial limits.
(A) High Eh (Positive redox potential) - Selectively favours the rapid growth of strictly anaerobic bacteria
(B) $a_w < 0.85$ - Inhibits the growth and proliferation of almost all common pathogenic vegetative bacteria
(C) pH < 4.6 - Prevents the biological germination of pathogenic Clostridium botulinum bacterial spores
(D) High salt content - Lowers the available free water activity (a_w) within the formulated food matrix

136. Which classical equation mathematically represents the first-order destruction kinetics used to determine the D-value?
(A) $F_0 = Z \times (\log D_0 - \log D_t)$
(B) $t = D \times (\log N_0 - \log N_t)$
(C) $A_w = p/p_0$
(D) $N_t = N_0 \times 2^n$

137. Consider the following statements about yeasts and moulds in food:
I. Yeasts are widely utilized in alcoholic fermentation due to their ability to produce ethanol from sugars.
II. Moulds are obligate anaerobes and require vacuum packaging to grow.
III. Certain moulds are capable of producing highly toxic secondary metabolites known as mycotoxins.
IV. Both yeasts and moulds can grow at lower water activities compared to most bacteria.
Which of the statements given above are correct?
(A) I, III and IV
(B) I, II and III
(C) II, III and IV
(D) I, II and IV

138. Consider the following statements regarding food shelf-life determination:
Statement I: Shelf-life determination strictly relies on sensory evaluation without any microbiological testing.
Statement II: Microbiological challenge testing is a robust method to determine if a food formulation can support the growth of specific pathogens.

Click Here to Buy book on Amazon

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

139. Match the fermentation metabolic product in List I with its role/effect in food in List II.
List I: (Metabolic product)
P. Lactic Acid
Q. Ethanol
R. Diacetyl
S. Propionic Acid
List II: (Role/effect)
I. Provides the characteristic butter flavour in dairy products.
II. Contributes to the "eyes" and characteristic flavour of Swiss cheese.
III. Primarily lowers pH to preserve food and provides a tart flavour.
IV. Provides intoxicating properties and acts as an antimicrobial at high concentrations.
(A) P-III, Q-IV, R-I, S-II
(B) P-III, Q-I, R-IV, S-II
(C) P-IV, Q-III, R-II, S-I
(D) P-I, Q-II, R-III, S-IV

140. Which of the following statements about foodborne viruses is incorrect?
(A) Viruses do not replicate or grow in food matrices.
(B) Foods act merely as a vehicle for the transfer of viruses to the host.
(C) Norovirus and Hepatitis A are among the most common foodborne viral pathogens.
(D) Viruses rapidly spoil food by utilizing carbohydrates to produce acid and gas.

141. Given below are an Assertion (A) and a Reason (R).
Assertion (A): Listeria monocytogenes is a significant pathogen of concern in refrigerated, ready-to-eat (RTE) foods.
Reason (R): Listeria monocytogenes is a psychrotrophic bacterium capable of multiplying at refrigeration temperatures (4°C).
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

142. In food processing terminology, what does the "12-D concept" refer to?
(A) A dehydration process that successfully reduces the free water activity (a_w) of processed food to exactly 0.12.
(B) A thermal process applied to low-acid canned foods to achieve a 12-log reduction of Clostridium botulinum spores.
(C) An advanced preservation method involving the structured addition of at least 12 distinct chemical hurdles to food.
(D) The industrial storage of perishable food products strictly at -12°C to completely prevent microbial spoilage.

143. A food scientist lowers the storage temperature of fresh milk from 10°C to 4°C. According to the principles of predictive microbiology (e.g., Q10 concept), what is the expected outcome on the microbial growth rate?
(A) The overall growth rate of the vegetative bacterial cells will mathematically double within the dairy system.
(B) The bacterial growth rate will remain completely constant, but the lag phase will completely vanish from the curve.
(C) The microbial population will immediately undergo a highly rapid, protective endospore sporulation in the milk.
(D) The microbial growth rate will decrease significantly, thereby substantially extending the product's shelf-life.

144. What is the cause-effect relationship of a ruptured biological structure (e.g., bruised fruit skin) on microbial spoilage?
(A) It causes exposure of nutrient-rich internal tissues to ambient flora, resulting in rapid microbial proliferation and spoilage.
(B) It causes the instant systemic release of highly active intrinsic antimicrobials that completely sterilize the raw fruit.
(C) It causes the immediate physical freezing of internal cellular water, which completely halts all native enzymatic activity.
(D) It causes a significant, rapid increase in the external surface pH, which strictly prevents any subsequent mould growth.

9. (B) III, I, IV, II
In a closed system, microorganisms initially undergo a lag phase to adapt and synthesize necessary enzymes. This is followed by the log phase of rapid exponential cell division. As nutrients deplete and toxic waste accumulates, the population enters a stable stationary phase before entering the decline or death phase where viable cells decrease.

10. (B) Eugenol - Cloves
Eugenol is a naturally occurring phenolic compound found in high concentrations in cloves, exhibiting potent antimicrobial activity against a broad spectrum of foodborne bacteria and fungi. Other examples of intrinsic antimicrobials include lactoperoxidase found in cow's milk, allicin present in garlic, and ovotransferrin located in egg whites, which naturally protect these materials from spoilage.

11. (A) Ambient storage temperature and nutrient availability
Raw milk is a nutrient-dense fluid rich in carbohydrates, proteins, and lipids, providing an ideal substrate for microbial proliferation. Storing this commodity at an ambient temperature of thirty degrees Celsius dramatically accelerates the growth kinetics of lactic acid bacteria. These organisms rapidly metabolize lactose into lactic acid, resulting in rapid souring of the product.

12. (C) Oxidation-reduction potential of the food
Extrinsic factors are environmental conditions external to the food itself, such as ambient storage temperature, relative humidity, and the gaseous composition of the surrounding atmosphere. Conversely, the oxidation-reduction potential, along with pH, water activity, and nutrient content, represents an intrinsic factor determined by the chemical composition and physical structure of the food matrix.

13. (D) Cells actively adapt to the new environment, synthesizing vital RNA, proteins, and enzymes.
During the lag phase of the microbial growth curve, cellular division does not occur, and the total population remains constant. However, the cells are highly active metabolically as they adapt to their new chemical and physical environment. They prioritize synthesizing critical cellular components, including ribosomal RNA, metabolic proteins, and essential enzymes required for upcoming replication.

14. (C) Using high Oxygen and elevated Carbon Dioxide modified atmosphere
To preserve fresh red meat, a high-oxygen modified atmosphere maintains myoglobin in its oxygenated form, oxymyoglobin, preserving the desired bright red color. Simultaneously, elevating carbon dioxide levels to around twenty to thirty percent effectively suppresses aerobic spoilage bacteria like Pseudomonas by disrupting their membrane function and extending their lag phase of growth.

15. (B) Halophiles - Require low osmotic pressure and zero salt to survive
Halophiles are specialized extremophilic microorganisms that require high concentrations of sodium chloride to maintain their cellular membrane integrity and enzymatic functions. They thrive in environments with high osmotic pressure. In contrast, psychrotrophs can grow at low refrigeration temperatures, mesophiles prefer moderate temperatures, and thermophiles require high temperatures for optimal metabolic activity and survival.

16. (C) 0.80
Water activity dictates the minimum moisture available for microbial replication. While most spoilage and pathogenic bacteria are inhibited at water activities below zero point nine zero, filamentous moulds are significantly more tolerant to dry conditions. The generally accepted minimum water activity required to support the germination and growth of common spoilage moulds is zero point eight zero.

17. (A) I, II and III
Relative humidity is an environmental factor that directly influences the moisture content of exposed foods. When dry foods are stored in high humidity, they absorb water vapor from the air until their internal water activity equilibrates with the surrounding atmosphere. This moisture uptake increases surface water activity, promoting rapid growth of spoilage moulds on the exterior.

18. (C) Statement I is correct but Statement II is incorrect.
Hurdle technology systematically combines mild preservation factors to ensure food safety and stability. The success of this approach relies heavily on the synergistic or additive effects of these hurdles, which disrupt microbial homeostasis at multiple cellular targets. This prevents

Downloaded from www.pdf.tube

ANSWERS

1. (A) The biological study of food-associated microbes, focusing on spoilage and safety.
Food microbiology primarily examines the physiological, ecological, and genetic characteristics of microorganisms that colonize, modify, or contaminate food matrices. This field focuses on understanding how these microbes cause food spoilage, transmit foodborne diseases, or facilitate beneficial fermentation, thereby ensuring the microbial safety and stability of consumable products throughout the supply chain.

2. (B) I, III and IV
Bacteria are prokaryotic and reproduce by binary fission, while moulds are multicellular filamentous fungi forming mycelia crucial in spoilage and fermentation. Viruses are non-cellular, obligate intracellular parasites that cannot replicate outside a host cell, meaning they never multiply in food matrices. Conversely, yeasts are unicellular, not multicellular, fungi that typically reproduce by budding.

3. (C) Statement I is correct but Statement II is incorrect.
Protozoa are indeed single-celled eukaryotic microorganisms that cause foodborne and waterborne infections upon ingestion of their survival cysts. However, unlike bacteria or fungi, protozoa are obligate parasites that require a compatible living host organism to replicate. Consequently, they are entirely incapable of multiplying or growing within inert food matrices during storage.

4. (A) P-IV, Q-I, R-III, S-II
Bacteria are highly diverse, encompassing lactic acid producers and pathogens. Yeasts serve as single-cell protein sources and leavening agents in baking. Moulds possess exceptional tolerance to low water activities, enabling growth below the typical bacterial threshold of zero point eight zero. Viruses cannot replicate in food but easily transmit via the fecal-oral route.

5. (B) Water activity measures total moisture content of food, rather than water available for microbial growth.
Water activity is a thermodynamic metric representing the ratio of water vapor pressure in food to that of pure water. It specifically measures the free, unbound water available to support microbial metabolic processes and cellular growth. Total moisture content, conversely, includes both bound and unbound water, making it a poor predictor of microbial shelf-life.

6. (A) Both A and R are true and R is the correct explanation of A.
Most pathogenic bacteria require high moisture levels to survive and proliferate, with a threshold water activity of zero point eight five. Restricting moisture below this level induces severe osmotic stress on bacterial cells. This osmotic imbalance dehydrates the cytoplasm, disrupts nutrient transport across the membrane, and halts cellular replication, preventing growth in dry foods.

NODIA

7. (D) Inherent physiological properties of the microorganisms, including growth rates, synergism, and antagonism.
Implicit factors represent the biological and physiological characteristics of the microorganisms themselves that dictate their survival and competition within a food matrix. These properties include specific growth rates, temperature tolerances, and interactive behaviors such as mutualistic synergism or competitive antagonism, which determine which microbial species will ultimately dominate and cause spoilage or fermentation.

8. (A) Hurdle technology
Hurdle technology involves the strategic combination of multiple preservation factors, such as low temperature, acidity, water activity, and chemical preservatives, to secure microbial stability. By combining a low pH of three point eight with sodium benzoate, the food processor establishes overlapping stress factors that collectively inhibit microbial growth more effectively than any single factor alone.

freudenreichii

116. Consider a case where a batch of vacuum-packed smoked salmon develops a blown package and a strong foul odour after 3 weeks of storage at 10°C, with a product pH of 6.2 and a_w of 0.96. What is the most likely cause of this spoilage?
(A) Rapid aerobic growth of psychrotrophic Pseudomonas species on the exposed surface of the smoked fish.
(B) Proliferation of psychrotrophic anaerobes or facultative anaerobes like Clostridium or certain Enterobacteriaceae.
(C) Extensive colonisation and filamentous growth of specialized xerophilic moulds on the low-moisture tissue layers.
(D) Rapid, non-enzymatic chemical autoxidation of unsaturated fish lipids leading to rancid, soapy off-flavours.

117. All of the following are examples of implicit factors that govern microbial survival in food, EXCEPT:
(A) Inherent rate of microbial cell division
(B) Production of antimicrobial bacteriocins
(C) Physical slicing of the food structure
(D) Synergistic utilization of by-products

118. Which of the following statements correctly describes the economic significance of microbial food spoilage?
(A) It is economically negligible in modern global food supply chains due to highly advanced aseptic packaging.
(B) Uncontrolled spoilage paradoxically increases the raw market value and consumer demand of fermented foods.
(C) The primary, major economic loss of food spoilage is restricted strictly to the operational cost of refrigeration.
(D) It results in significant loss of edible biomass, financial losses to producers, and increased costs of food disposal.

119. A competency required by an FSO is distinguishing between chemical and microbial spoilage. If a canned fruit product shows a slow, continuous accumulation of hydrogen gas causing a "hydrogen swell" without any microbial cells present upon microscopic examination, what is the cause?
(A) Chemical reaction between the fruit acids and the metal of the can.
(B) Enzymatic active fermentation by survived heat-resistant yeast spores.
(C) Anaerobic proteolytic degradation by heat-resistant thermophilic bacteria.
(D) Direct non-enzymatic lipolytic rancidity of protective fruit waxes.

120. Which of the following control measures is BEST described as a non-thermal process used to extend shelf-life by utilizing high hydrostatic pressure?
(A) Ohmic heating
(B) High Pressure Processing (HPP)
(C) Microwave pasteurization
(D) Extrusion cooking

121. What is the primary function of the bacterial growth curve's lag phase?
(A) Rapid, unrestricted exponential multiplication of active vegetative cells in the food.
(B) Adaptation to the new environment and synthesis of essential enzymes without cell division.
(C) Initiation of active cellular sporulation and synthesis of toxic secondary metabolites.
(D) Programmed autolysis of older cells to provide essential carbon nutrients for new ones.

122. Consider the following statements regarding the control of food spoilage:
I. Blanching primarily inactivates spoilage enzymes prior to freezing or canning.
II. Freezing destroys microbial toxins pre-formed in the food.
III. Chemical preservatives like benzoates are more effective at lower pH values.
IV. Pasteurization is designed to eliminate all microbial spores in food.
Which of the statements given above are correct?
(A) I and III only
(B) I, II and III
(C) II and IV only
(D) I, III and IV

123. Consider the following statements regarding the D-value in thermal processing:
Statement I: The D-value is specific to a particular microorganism and a particular temperature.
Statement II: A higher D-value indicates that the microorganism is less resistant to heat.

Click Here to Buy book on Amazon

adaptation and survival, meaning the hurdles do not act independently but work cooperatively to inhibit growth.

19. (A) P-IV, Q-III, R-I, S-II
Antagonism involves the suppression of one microbial species by another through competition. Synergism represents a mutually beneficial relationship where species assist each other's survival. Commensalism occurs when one organism benefits without affecting the other. Amensalism is a relationship where one species produces inhibitory substances, such as bacteriocins or acids, that directly destroy or restrict a competing species.

20. (D) The total number of viable bacterial cells strictly decreases at an exponential rate.
The stationary phase of the growth curve is characterized by a dynamic equilibrium where the rate of new cell division equals the rate of cell death, keeping the viable count stable. This phase is triggered by nutrient depletion and toxic waste accumulation. Exponential decline in viable cell numbers occurs only later, during the death or decline phase.

21. (C) A is true but R is false.
Spores of Clostridium botulinum are highly sensitive to acidic environments and cannot germinate or produce lethal neurotoxins at a pH below four point six. However, the pre-formed botulinum neurotoxin itself is not degraded by acidity. It remains stable under acidic conditions and must be inactivated by heat, making the assertion true but the reason false.

22. (C) The time required to achieve a 1-log reduction (90% destruction) of a specific microbial population at a given temperature.
The D-value, or decimal reduction time, is a key parameter in thermal death kinetics. It is defined as the thermal exposure time, in minutes, required to reduce a specific microbial population by ninety percent, or one logarithmic cycle, at a constant temperature. It quantifies the relative heat resistance of a target organism under specific conditions.

23. (B) 2.4 minutes
To achieve a standard twelve decimal reduction process, also known as the twelve-D concept, the total thermal holding time is calculated by multiplying the D-value of the target microorganism by twelve. Given a D-value at one hundred twenty-one degrees Celsius of zero point two minutes, the required holding time is precisely two point four minutes.

24. (A) It significantly extends the lag phase of aerobic spoilage bacteria like Pseudomonas.
Elevating carbon dioxide concentrations to twenty to thirty percent in modified atmosphere packaging creates an inhibitory environment for aerobic microorganisms. Carbon dioxide dissolves into the aqueous phase of meat, forming carbonic acid that lowers internal cellular pH. This disruption extends the lag phase and reduces the growth rate of aerobic spoilage bacteria such as Pseudomonas.

25. (B) F-value - Time required at a specific temperature to achieve a desired log reduction.
The F-value represents the total time required at a specific reference temperature to achieve a defined reduction in the population of a target microorganism. In contrast, the D-value is the time for a ninety percent reduction, while the Z-value is the temperature change required to alter the D-value by one decimal log cycle.

26. (B) Survival of thermophilic spore-formers like Geobacillus stearothermophilus due to improper cooling or storage.
When canned peas are processed to standard sterile levels, highly heat-resistant spores of thermophilic bacteria like Geobacillus stearothermophilus can survive. If the cans are not cooled rapidly post-processing or are stored at warm temperatures, these surviving spores germinate and grow. This leads to flat sour or gaseous spoilage, even though pathogens were eliminated.

27. (A) High acidity (low pH)
The physical and chemical environment significantly influences the heat resistance of bacterial endospores. High concentrations of lipids, proteins, and low water activity protect proteins from denaturation, increasing spore heat resistance. Conversely, high acidity, or low pH, sensitizes spores to thermal destruction, reducing their heat resistance and allowing lower pasteurization or sterilization times.

Downloaded from www.pdf.tube

28. (C) It is the specific change in temperature required to alter the microbial D-value by one decimal log cycle.
The Z-value is a fundamental parameter in thermal processing kinetics. It represents the temperature increase or decrease required to change the decimal reduction time, or D-value, of a specific microorganism by a factor of ten, which corresponds to one logarithmic cycle. It quantifies how sensitive a microbe's thermal resistance is to changes in temperature.

29. (B) 0.5 minutes
The Z-value defines the temperature increase required to reduce the D-value of a microorganism by ninety percent, or one logarithmic cycle. With a Z-value of ten degrees Celsius, raising the temperature from one hundred ten to one hundred twenty degrees Celsius represents a ten-degree increase. This mathematically reduces the D-value from five minutes to zero point five minutes.

30. (C) They cause organoleptic degradation through active proteolysis, lipolysis, and gas production.
Microorganisms are considered to have detrimental effects on food quality when their metabolic activities degrade the sensory properties of the food matrix. Through enzymes that catalyze proteolysis, lipolysis, and carbohydrate fermentation, they generate foul off-odors, rancid off-flavors, slime, discoloration, and gas, rendering the product unappealing and completely unacceptable for human consumption.

31. (B) Bacterial genera Lactobacillus, Lactococcus, and Leuconostoc in fermentation
Lactic acid fermentation is driven by specialized Gram-positive bacteria belonging to genera such as Lactobacillus, Lactococcus, and Leuconostoc. These bacteria ferment simple carbohydrates present in raw substrates like milk or cabbage, producing lactic acid as their primary metabolite. This production lowers the pH, providing characteristic sour flavors while inhibiting spoilage microorganisms.

32. (A) I and III only
Fermentation improves food quality by synthesizing vitamins and reducing anti-nutritional factors like phytates. However, fermentation does not rely exclusively on anaerobic respiration, as many starter cultures use fermentative metabolic pathways or facultative anaerobic respiration. Additionally, fermentation increases rather than decreases shelf-life by producing preserving acids and bacteriocins that prevent microbial spoilage.

33. (A) Both Statement I and Statement II are correct.
Homofermentative lactic acid bacteria utilize the Embden-Meyerhof-Parnas pathway to metabolize hexose sugars, yielding lactic acid as virtually the sole end-product. In contrast, heterofermentative species utilize the phosphoketolase pathway. This pathway produces equimolar amounts of lactic acid, carbon dioxide, and ethanol or acetic acid, contributing to the unique sensory profiles of fermented foods.

NODIA

34. (A) P-III, Q-IV, R-I, S-II
Sauerkraut production depends on succession starting with Leuconostoc mesenteroides and finishing with Lactobacillus plantarum. Beer requires alcoholic fermentation by Saccharomyces cerevisiae. Tempeh is a fermented soybean product utilizing the filamentous fungus Rhizopus oligosporus. Yogurt relies on the cooperative growth of Lactobacillus bulgaricus and Streptococcus thermophilus to produce lactic acid and acetaldehyde.

35. (A) Penicillium roqueforti is a bacterial starter culture specifically used to ripen blue-veined cheeses.
Penicillium roqueforti is a filamentous fungus, or mould, rather than a bacterium. It is inoculated into cheese curd to develop the blue veins, sharp flavor, and crumbly texture characteristic of Roquefort and gorgonzola. Other aspects of cheese making, such as casein coagulation by rennet and eye formation by Propionibacterium species, are correct.

36. (A) Both A and R are true and R is the correct explanation of A.
Traditional idli batter fermentation is a natural, spontaneous process that does not require the addition of commercial starter cultures. The fermentation is initiated entirely by the diverse epiphytic microflora, particularly Leuconostoc mesenteroides and Enterococcus faecalis, which are naturally present on the raw black gram and rice grains used in the batter preparation.

37. (B) The use of filamentous fungi to enzymatically break down complex macronutrients into simpler compounds, yielding distinct textures and flavors. Mould-based fermentation utilizes safe, filamentous fungi to produce high levels of extracellular enzymes such as amylases, proteases, and lipases. These enzymes hydrolyze complex macromolecules in raw substrates like soybeans or grains into digestible nutrients. This biochemical modification yields unique textures, rich flavors, and preserved foods like tempeh, koji, and matured cheeses.

38. (C) Solid-state fermentation using Aspergillus species to produce a high concentration of amylases and proteases.
The preparation of koji is a solid-state fermentation process where steamed grains are inoculated with Aspergillus oryzae or Aspergillus sojae. The mould grows over the substrate, secreting massive quantities of amylases and proteases. These enzymes hydrolyze starch and proteins into simple sugars and amino acids, preparing the substrate for subsequent brine fermentation.

39. (B) II, III, I
Sauerkraut fermentation occurs through a precise succession of microbial populations. Initially, naturally occurring coliforms and epiphytic bacteria initiate the process. As oxygen is consumed, Leuconostoc mesenteroides dominates, lowering the pH and producing carbon dioxide. Finally, acid-tolerant species like Lactobacillus plantarum proliferate to complete the fermentation, raising the total acidity.

40. (A) Dosa - Alcoholic and lactic acid fermentation
Dosa batter undergoes a mixed fermentation driven by lactic acid bacteria and natural yeasts. These organisms produce lactic acid for souring and carbon dioxide and ethanol for leavening. Conversely, wine is purely an alcoholic fermentation, pickles rely on lactic acid bacteria rather than moulds, and tempeh is a fungal, mould-based fermentation of soybeans.

41. (B) Contamination with Pediococcus or mutant yeast leading to excessive diacetyl production.
The butterscotch or buttery off-odor in beer is caused by diacetyl, a vicinal diketone. While yeast produces diacetyl intermediates during normal fermentation, it typically reabsorbs them. Contamination with lactic acid bacteria like Pediococcus or the presence of respiratory-deficient mutant yeast strains leads to excessive, uncontrolled accumulation of diacetyl, ruining the sensory quality of the beer.

42. (B) Kombucha
Dhokla, bhatura, and appam are traditional Indian fermented foods prepared using indigenous cereal or legume batters fermented by native lactic acid bacteria and yeasts. Kombucha, in contrast, is a fermented sweetened tea beverage of East Asian origin. It is produced using a symbiotic culture of acetic acid bacteria and yeasts, known as SCOBY.

43. (A) Leuconostoc mesenteroides is primarily responsible for leavening the batter.
In the fermentation of idli and dosa batter, the heterofermentative bacterium Leuconostoc mesenteroides plays a critical role. It produces carbon dioxide gas, which gets trapped in the viscous batter, causing essential leavening. Fermentation also increases the bioavailability of B-vitamins and amino acids, refuting the claims that bacteria are uninvolved or that sterilization is necessary.

44. (C) Maintaining the fermentation temperature within the specific yeast strain's optimal range of 15-25°C.
To ensure successful fermentation by Saccharomyces cerevisiae and avoid stuck or sluggish fermentations, temperature control is critical. Yeast metabolism is highly temperature-dependent. Maintaining the temperature between fifteen and twenty-five degrees Celsius optimizes growth kinetics and ethanol production while preventing thermal stress or premature yeast cell death during the wine-making process.

45. (D) Streptococcus thermophilus - Beer
Streptococcus thermophilus is a lactic acid bacterium used in high-temperature dairy fermentations like yogurt making, not in beer brewing. Beer production relies on alcoholic fermentation by yeasts, specifically Saccharomyces cerevisiae or Saccharomyces pastorianus. Other pairs, including Acetobacter for vinegar, Saccharomyces ellipsoideus for wine, and Aspergillus oryzae for koji, are correct.

Click Here to Buy book on Amazon

46. (C) Any change in food that renders it unacceptable for human consumption due to sensory, physical, or chemical defects.
Food spoilage is defined as any undesirable change in a food product that makes it unpalatable, unsafe, or otherwise unacceptable for human consumption. These changes are typically driven by microbial growth, enzymatic activity, or chemical reactions, leading to visible defects in texture, appearance, color, or the development of unpleasant off-odors and off-flavors.

47. (A) I, II and IV
Grains with moisture levels above zero point eight five are highly vulnerable to mould spoilage. Storage moulds, primarily Aspergillus and Penicillium, proliferate during warehouse storage. Field moulds like Fusarium infect crops before harvest. Crucially, mould spoilage often leads to chemical toxicity through the synthesis of hazardous secondary metabolites known as mycotoxins.

48. (D) Statement I is incorrect but Statement II is correct.
Fruits typically have an acidic pH, often below four point five, which is highly inhibitory to most common spoilage bacteria. This low pH creates an ecological niche that selectively favors acid-tolerant fungi. Consequently, fruits are primarily susceptible to mould and yeast spoilage rather than bacterial spoilage, which dominates in neutral-pH vegetables.

49. (A) P-II, Q-I, R-IV, S-III
Proteolysis in meat releases hydrogen sulfide and amines, generating putrid odors. Lipolysis in butter hydrolyzes fats into volatile fatty acids, causing rancidity. Carbohydrate fermentation in juices produces high levels of organic acids and carbon dioxide gas. Slime formation on vegetables is driven by the surface accumulation of bacterial exopolysaccharide capsules.

50. (C) Raw milk spoils initially through putrefaction because lactic acid bacteria are absent.
Raw milk naturally contains a diverse microflora, including lactic acid bacteria. Consequently, raw milk initially spoils through souring as these bacteria ferment lactose into lactic acid, lowering the pH. Putrefaction occurs only much later when proteins are degraded. Other dairy defects, like bitty cream from Bacillus cereus, are correctly identified.

51. (A) Both A and R are true and R is the correct explanation of A.
Meat is highly perishable and serves as an ideal substrate for rapid microbial growth. This susceptibility is due to its highly favorable intrinsic factors. It contains abundant proteins and moisture, yielding a high water activity exceeding zero point nine eight, and has a post-rigor pH of five point five to six point five, supporting diverse bacteria.

52. (D) Enzymatic spoilage is caused by intrinsic food enzymes degrading tissue, while microbial spoilage relies on enzymes secreted by actively proliferating microbes.
Enzymatic spoilage is driven by endogenous enzymes naturally present within the plant or animal tissues, such as polyphenol oxidase or lipoxygenase, which continue to function post-harvest. In contrast, microbial spoilage is caused by extracellular enzymes secreted by actively growing bacteria, yeasts, or moulds as they break down the food substrate for nutrients.

53. (B) Growth of psychrotrophic, microaerophilic lactic acid bacteria like Weissella or Leuconostoc producing hydrogen peroxide.
The greening of vacuum-packed cured meats like frankfurters is caused by hydrogen peroxide-producing, psychrotrophic lactic acid bacteria, including Weissella viridescens. In low-oxygen packaging, these bacteria grow and produce hydrogen peroxide. This strong oxidizing agent reacts with cured meat pigments, converting nitrosohemochrome into green choleglobin, producing a green discoloration and sour odor.

54. (C) Putrefaction
Putrefaction is the anaerobic decomposition of proteins by microbial enzymes, resulting in the breakdown of amino acids. This biochemical process yields foul-smelling nitrogenous and sulfurous compounds, including hydrogen sulfide, ammonia, cadaverine, and putrescine. In contrast, fermentation refers to carbohydrate breakdown, while saccharification and caramelization involve starch hydrolysis and sugar heating.

NODIA

55. (D) Zygosaccharomyces bailii generating carbon dioxide gas and turbidity in fruit juices
Zygosaccharomyces bailii is a highly osmotolerant and aciduric yeast capable of spoiling high-sugar, low-pH foods like fruit juices. It ferments simple sugars into ethanol and carbon dioxide, causing

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

significant container swelling, gas bubbles, and visual turbidity. Other options represent incorrect pairings of microbial species with their typical spoilage environments and metabolites.

56. (A) Pectinolytic enzymes secreted by Erwinia carotovora (now Pectobacterium).
Bacterial soft rot in carrots and other root vegetables is primarily caused by Erwinia carotovora. This phytopathogen secretes highly active pectolytic enzymes, particularly pectin methylesterase and polygalacturonase. These enzymes hydrolyze the pectin in the plant cell wall, collapsing the tissue structure and reducing the vegetable to a soft, mushy, and foul-smelling mass.

57. (B) Increase in total soluble solids (Brix) in fruit juices
Microbial spoilage of fruit juices involves the consumption of simple sugars by fermentative yeasts and bacteria, which decreases the total soluble solids, or Brix value. Common indicators of spoilage include surface slime, container swelling due to carbon dioxide, off-odors like hydrogen sulfide, and discoloration. An increase in Brix does not indicate microbial spoilage.

58. (B) It causes massive financial losses globally across the supply chain, from harvest to retail.
Microbial food spoilage has immense global economic significance, as it causes massive financial losses throughout the food supply chain. Significant percentages of harvested agricultural commodities, dairy products, meat, and seafood are discarded annually before reaching consumers. These losses increase prices, reduce food security, and waste critical agricultural, water, and transport resources.

59. (A) Decreasing pH, adding potassium sorbate, and storing at 4°C.
To extend the shelf-life of a delicate dairy dessert, applying hurdle technology is ideal. Combining a slightly decreased pH with the addition of potassium sorbate, an effective antifungal preservative, and storing the product under refrigeration at four degrees Celsius creates multiple, overlapping sub-lethal barriers. This combination inhibits spoilage yeasts, moulds, and psychrotrophic bacteria.

60. (C) Production of Trimethylamine (TMA) and volatile basic nitrogen (VBN)
Marine fish contain high levels of trimethylamine oxide, which serves as an osmoregulator. Post-mortem, spoilage bacteria like Shewanella and Pseudomonas reduce this compound into volatile trimethylamine. Measuring trimethylamine and total volatile basic nitrogen provides a reliable, objective chemical indicator of microbial protein degradation and advanced spoilage in chilled seafood.

61. (D) The processing time in minutes required to achieve a 1-log (90%) reduction in a target microbial population at a constant temperature.
The decimal reduction time, or D-value, is a fundamental metric in food preservation and thermal process calculations. It represents the heating time, in minutes, required to reduce a specific microbial population by ninety percent, which is equivalent to a one-log reduction, at a constant, defined temperature.

62. (B) I, II and III
The rate of food spoilage is governed by multiple interconnected factors. These include the initial microbial load or bioburden, which dictates the time to reach spoilage levels, and the integrity of natural physical barriers that prevent microbial entry. Maintaining a cold chain during transport reduces growth kinetics, while aesthetic packaging designs do not influence microbial growth.

63. (D) Statement I is incorrect but Statement II is correct.
Chemical spoilage, such as oxidative rancidity in fats, occurs through non-microbial pathways like lipid autoxidation, which are accelerated by exposure to light, oxygen, heat, and trace heavy metals. This process is not directly caused by bacterial metabolism, though microbial lipases can release free fatty acids that are more susceptible to subsequent oxidation.

64. (A) P-III, Q-II, R-IV, S-I
Pasteurization uses mild thermal energy to destroy vegetative pathogens and spoilage organisms. Freezing lowers water activity by forming ice crystals, halting microbial metabolic activity. Modified atmosphere packaging alters ambient gas concentrations to inhibit aerobic respiration. Sodium nitrite is added to cured meats specifically to inhibit the germination and

Downloaded from www.pdf.tube

and sorbates are weak organic acids; they are more effective at lower pH values where they remain undissociated and can penetrate microbial membranes. Conversely, freezing does not destroy pre-formed toxins, and pasteurization does not eliminate bacterial spores.

123. (C) Statement I is correct but Statement II is incorrect.
The D-value is specific to a particular microorganism, temperature, and food substrate. However, a higher D-value indicates that the organism is more resistant to thermal destruction, requiring a longer heating duration to achieve a ninety percent reduction. Therefore, the first statement is correct, while the second statement is incorrect.

124. (A) P-III, Q-IV, R-I, S-II
Freezing halts enzymatic activity and forms ice crystals that dehydrate cells. Modified atmosphere packaging with high carbon dioxide extends the lag phase of aerobic spoilage bacteria. High relative humidity promotes moisture absorption and the surface growth of moulds. Thermal processing uses heat to denature essential proteins and nucleic acids, destroying vegetative cells.

125. (C) Discolouration in fresh meat, such as a shift from red to brown, is always purely a microbial process and never a chemical autoxidation.
Discoloration in fresh meat is not always purely a microbial process. A shift from bright red oxymyoglobin to dull brown metmyoglobin is often a chemical autoxidation process. This reaction occurs when myoglobin is exposed to oxygen, light, or heat, independent of microbial growth, making the statement strictly incorrect and invalid.

126. (A) Both A and R are true and R is the correct explanation of A.
The use of nitrites in cured meats is essential for preventing botulism, a potentially fatal foodborne illness. Nitrites act as a highly effective preservative by inhibiting the metabolic enzymes of Clostridium botulinum. This inhibition prevents the germination and outgrowth of bacterial spores, thereby blocking the synthesis of the lethal neurotoxin.

127. (D) The ratio of the water vapour pressure of the food to the vapour pressure of pure water at the same temperature.
In food science, water activity is a thermodynamic metric defined as the ratio of the water vapor pressure of the food product to the vapor pressure of pure water at the same temperature. It measures the free, unbound water available to support microbial growth and chemical reactions, rather than the total moisture content.

128. (A) The Hurdle Effect
Formulating a shelf-stable mayonnaise by combining acetic acid and salt utilizes the hurdle effect. The acetic acid lowers the pH, while the salt reduces the water activity. Together, these sub-lethal barriers act synergistically to disrupt microbial homeostasis, preventing the growth of spoilage and pathogenic organisms more effectively than either factor alone.

129. (A) II, IV, III, I
Using a predictive microbiology approach involves a systematic sequence. First, the primary spoilage or pathogenic microorganism of concern is identified. Next, product formulation data, including pH and water activity, is gathered. Mathematical models are then used to predict growth based on these parameters, and the model is validated using real food matrices.

130. (A) Koji - Aspergillus oryzae
Koji is prepared by fermenting steamed grains with Aspergillus oryzae. This mould secretes high concentrations of amylases and proteases, which are essential for hydrolyzing starch and proteins in subsequent soy sauce or miso production. Other pairs, such as idli with Saccharomyces or kombucha with Lactobacillus, do not represent the primary defining microorganisms.

NODIA

131. (D) The elevated pH failed to inhibit the growth of pathogenic bacteria such as Staphylococcus aureus or Salmonella.
During sausage fermentation, lactic acid bacteria must produce sufficient acid to lower the pH below five point zero. If the fermentation fails and the pH remains elevated at five point eight, the protective acid barrier is compromised. This elevated pH fails to inhibit pathogens like Staphylococcus aureus or Salmonella, leading to potential food poisoning.

74. (B) The protocol lacks end-of-shelf-life testing and fails to monitor psychrotrophic spoilage flora or pathogens like Listeria monocytogenes.
A robust shelf-life validation protocol must evaluate microbiological safety and quality at the end of the proposed storage period. Testing only for coliforms on Day one fails to account for psychrotrophic pathogens like Listeria monocytogenes, which can multiply at refrigeration temperatures, or spoilage bacteria and moulds that proliferate over fourteen days of storage.

75. (A) Homogenization - Destroys bacterial endospores
Homogenization is a physical process designed to reduce the size of fat globules in milk, preventing fat separation, and does not exert sufficient thermal or mechanical energy to destroy bacterial endospores. Conversely, dehydration successfully lowers water activity, vacuum packaging reduces available oxygen, and blanching inactivates deteriorative endogenous enzymes in fruits and vegetables.

76. (C) They are utilized in processes like fermentation to improve flavour, texture, preservation, and nutritional value.
Microorganisms are classified as beneficial in food microbiology when they are deliberately utilized to enhance food properties. Through fermentation, these yeasts, bacteria, and moulds metabolize raw substrates, producing organic acids, ethanol, and volatile compounds that improve flavor, develop unique textures, synthesize essential vitamins, and extend shelf-life by natural preservation.

77. (B) I, III and IV
Lactic acid bacteria are Gram-positive, non-spore-forming organisms found on plants and in milk. They are aerotolerant anaerobes or microaerophiles rather than obligate aerobes, as they do not require oxygen for respiration. They ferment sugars into lactic acid, lowering the food's pH and inhibiting the growth of competing pathogenic and spoilage bacteria.

78. (B) Both Statement I and Statement II are incorrect.
The Z-value is not a time measurement; it represents the temperature change required to alter the D-value by one logarithmic cycle. Similarly, the F-value is a time measurement rather than a temperature, denoting the total heating duration required to achieve a specific microbial log reduction at a reference temperature, making both statements incorrect.

79. (A) P-II, Q-I, R-IV, S-III
Low-acid canned food sterilization targets highly heat-resistant spores of Clostridium botulinum. Milk pasteurization is designed to eliminate Coxiella burnetii, the most heat-resistant vegetative pathogen in raw milk. High-acid food processing targets acid-tolerant spoilage moulds and lactobacilli, while beer pasteurization targets spoilage yeasts and lactic acid bacteria that affect beer quality.

80. (A) Implicit factors refer to the technological interventions (like irradiation) applied by food processors.
Implicit factors are the physiological characteristics of the microorganisms themselves, such as growth rates, temperature tolerances, and mutualistic or antagonistic interactions. They do not refer to technological interventions, which are external process-oriented controls. Examples of implicit factors include the production of bacteriocins by lactic acid bacteria to suppress competitors.

81. (A) Both A and R are true and R is the correct explanation of A.
Salmonella is highly sensitive to acidic environments and cannot survive or multiply in commercially produced mayonnaise. This is because commercial mayonnaise is formulated with vinegar or citric acid to achieve an equilibrium pH below four point one. This high acidity is directly bactericidal or strongly inhibitory to enteropathogenic bacteria like Salmonella.

82. (A) The time required for a microbial population to double in number during the log phase.
In food microbiology, generation time, or doubling time, is the time required for a microbial population to double in number during the logarithmic, or exponential, growth phase. It reflects how rapidly a specific bacterial or fungal species can multiply under defined environmental conditions like temperature, pH, and water activity.

83. (D) The lag phase is vastly extended, or active growth halts without causing immediate cell death.
Bacteriostatic agents operate by inhibiting the metabolic replication and cellular division of bacteria without actively destroying the cells.

Click Here to Buy book on Amazon

outgrowth of anaerobic Clostridium botulinum spores.

65. (A) Challenge testing involves determining the nutritional profile of the food after varying periods.
Challenge testing is a microbiological validation method where a food product is inoculated with specific pathogens or spoilage organisms to monitor their survival or growth over time under defined conditions. It does not focus on determining the nutritional profile of the food, which is a chemical analysis unrelated to microbial safety validation.

66. (A) Both A and R are true and R is the correct explanation of A.
Accelerated shelf-life testing relies on the Arrhenius equation to model how temperature elevations accelerate chemical degradation reactions in food. By determining the activation energy of the primary deteriorative reaction, food scientists can mathematically extrapolate these degradation rates back to normal storage temperatures, allowing rapid and accurate predictions of product shelf-life.

67. (A) The condition achieved by application of heat which renders the food free of microorganisms capable of reproducing in the food under normal non-refrigerated conditions of storage.
Commercial sterility is a thermal processing standard for canned foods. It does not require absolute sterility, which is the total destruction of all organisms. Instead, it ensures the destruction of all pathogens, particularly Clostridium botulinum, and any spoilage organisms capable of reproducing in the food under normal, non-refrigerated storage and distribution conditions.

68. (D) Shift in the implicit factors allowing less acid-tolerant pathogens like Salmonella to proliferate.
When a food product relies on a low pH for preservation and the pH accidentally rises, the protective barrier is compromised. This shift alters the environmental constraints, allowing less acid-tolerant pathogenic bacteria, such as Salmonella, to survive and proliferate. This represents a fundamental change in the hurdles keeping the food microbiologically stable.

69. (A) III, I, II, IV
Conducting a microbial challenge study follows a systematic sequence. First, the specific food product formulation must be manufactured. Next, the batch is inoculated with a known, standardized concentration of the target pathogen. The samples are then stored under controlled environmental conditions, followed by periodic sampling and enumeration to assess growth or decline.

70. (C) Challenge testing - Artificially contaminating food to assess the viability of pathogens over time.
Challenge testing involves the deliberate, artificial inoculation of a food matrix with a specific pathogen or spoilage organism, followed by monitoring its viability and growth over time under various storage conditions. This directly validates whether a product formulation or packaging system can effectively prevent microbial hazards during its commercial shelf-life.

71. (D) Mould spoilage
The appearance of white and green patches on a high-moisture cake indicates fungal contamination. Identifying multicellular eukaryotic organisms with septate hyphae confirms the presence of filamentous moulds, such as Penicillium or Aspergillus. These fungi utilize the carbohydrates and moisture in the baked product to grow, causing visible and sensory mould spoilage.

NODIA

72. (A) Relative humidity
Hurdle technology distinguishes between intrinsic and extrinsic parameters. Intrinsic parameters are inherent characteristics of the food matrix, such as acidity, redox potential, and competitive microflora. Relative humidity, conversely, is an environmental condition external to the food, making it an extrinsic factor rather than an intrinsic hurdle used to extend shelf-life.

73. (B) Food irradiation utilizing Gamma rays relies on ionizing energy to irreversibly damage microbial DNA, thereby controlling spoilage.`
Food irradiation is a highly effective cold preservation technique. It exposes food to ionizing radiation, such as gamma rays, which directly disrupts or breaks the phosphodiester backbone of microbial DNA. This genetic damage prevents the replication of vegetative bacteria, yeasts, and moulds, effectively extending the shelf-life and improving the microbiological safety of treated foods.

93. (D) Statement I is incorrect but Statement II is correct.
Fresh meat contains very low levels of carbohydrates. Consequently, meat spoilage is driven by the microbial catabolism of proteins and amino acids. This proteolytic degradation yields alkaline, foul-smelling nitrogenous and sulfurous compounds like ammonia, hydrogen sulfide, putrescine, and cadaverine, which cause the characteristic putrid off-odors of spoiled meat.

94. (A) P-III, Q-II, R-I, S-IV
Dosa is prepared by fermenting a rice and black gram batter. Gundruk is a traditional Nepalese and Indian fermented leafy vegetable product. Rabdi is a fermented beverage utilizing pearl millet and buttermilk. Toddy is an alcoholic beverage produced through the natural fermentation of sweet sap tapped from palm trees.

95. (D) Yeasts are strictly obligate anaerobes.
Yeasts are not strictly obligate anaerobes; they are facultative anaerobes. They can grow aerobically using respiratory metabolism, which yields biomass, or anaerobically via fermentation, producing ethanol and carbon dioxide. They prefer slightly acidic conditions, require higher water activity than moulds, and Saccharomyces cerevisiae is heavily utilized in baking and brewing.

96. (D) A is false but R is true.
Refrigeration downregulates microbial enzyme kinetics and metabolic rates, slowing growth. However, it does not halt the growth of all microorganisms or prevent spoilage indefinitely. Psychrotrophic pathogens and spoilage organisms can multiply at refrigeration temperatures. Thus, refrigeration only extends shelf-life rather than preserving food indefinitely, making the assertion false and the reason true.

97. (C) Naturally occurring chemical substances within the food matrix that exhibit bacteriostatic or bactericidal properties.
In food microbiology, an intrinsic antimicrobial is a naturally occurring chemical compound within the food matrix that inhibits or destroys microorganisms. Examples include lysozyme in egg whites, lactoferoxidase in milk, and essential oils like eugenol in cloves. These substances provide an inherent biochemical defense system against microbial contamination and spoilage.

NODIA

98. (A) Core temperature over time
Calculating the integrated lethality, or F-value, requires monitoring the temperature profile at the slowest heating point, or cold point, of the food container. This calculation integrates the lethal rates achieved at each temperature over the heating and cooling phases, relying on the continuous measurement of core temperature over time.

99. (A) I, III, IV, II
Microorganisms vary in their tolerance to low water activity. Xerophilic moulds are the most tolerant, surviving in extremely dry environments. Osmophilic yeasts are also highly tolerant, growing in high-sugar substrates. Gram-positive bacteria are moderately tolerant, while Gram-negative bacteria are the most sensitive, requiring high water activities to replicate.

100. (B) Hepatitis A - Fecal-oral route via contaminated water/food handlers
Hepatitis A is a highly infectious foodborne virus transmitted primarily via the fecal-oral route. Transmission occurs when food or water is contaminated by sewage or infected food handlers practicing poor hygiene. Unlike bacteria, viruses do not multiply in food, which serves merely as a passive vehicle to infect the host.

101. (C) Exopolysaccharide (capsule) production by bacteria such as Alcaligenes viscolactis or certain LAB
Ropy or stringy milk is a spoilage defect characterized by the formation of viscous slime threads when the milk is poured. This defect is caused by the synthesis of extracellular slime layers, or exopolysaccharides, by specific bacteria. Organisms like Alcaligenes viscolactis or certain ropy strains of lactic acid bacteria produce these capsules.

102. (D) Storage atmosphere composition and gas concentration
Intrinsic parameters are inherent properties of the food itself, such as nutrient content, pH, oxidation-reduction potential, and biological barriers. Conversely, the composition of the storage atmosphere, including carbon dioxide and nitrogen levels, is an environmental condition external to the food, classifying it as an extrinsic parameter of growth.

103. (A) It determines the relative resistance of a microorganism to different lethal temperatures.
The Z-value is a key parameter in thermal death kinetics. It represents the temperature change required to produce a ten-fold change in the decimal reduction time, or D-value. This value quantifies the thermal sensitivity of a specific microorganism, determining its relative heat resistance across different lethal processing temperatures.

104. (B) Knowing that *S.* aureus can grow at relatively low a_w (up to 0.86) and its pre-formed toxin is heat-stable.
Staphylococcus aureus is highly tolerant to low water activity, allowing it to grow down to zero point eight six in bakery products. While the bacterial cells can be destroyed by heat, they produce enterotoxins that are extremely heat-stable. These toxins resist pasteurization and boiling, presenting a major food safety hazard if pre-formed in food.

105. (B) Putrefaction - Fermentation of complex carbohydrates
Putrefaction is the microbial decomposition of proteins and amino acids, yielding foul-smelling nitrogenous compounds like putrescine and cadaverine. It is not the fermentation of carbohydrates, which instead leads to souring and gas production. Other pairings, such as lipid oxidation causing rancidity and acid accumulation causing sourness, are correct.

106. (A) Escherichia coli
Escherichia coli is a Gram-negative, rod-shaped bacterium naturally residing in the intestinal tracts of warm-blooded animals. Due to its specific origin, its presence in food or water serves as a classic indicator of direct fecal contamination. This indicates poor hygiene practices and a high risk of exposure to enteric pathogens.

107. (A) I and II only
Under aerobic refrigeration, fresh meat is spoiled by psychrotrophic Pseudomonas species, which produce slime and off-odors. Vacuum packaging excludes oxygen, shifting the microflora to facultative anaerobic lactic acid bacteria. Conversely, deep tissue bone taint is caused by anaerobic bacteria like Clostridium, and high fat content does not render meat immune to spoilage.

108. (C) Statement I is correct but Statement II is incorrect.
During the log phase, the microbial population divides at a constant exponential rate, which can be mathematically modeled. However, this specific growth rate is highly dependent on environmental temperature. As temperature increases within the organism's growth range, enzymatic reactions accelerate, leading to a faster division rate and shorter generation times.

109. (A) P-III, Q-IV, R-II, S-I
Flat sour spoilage produces acid without gas, leaving the can flat. Thermophilic anaerobes produce abundant gas, swelling the cans. Sulfide stinker spoilage, caused by Desulfotomaculum nigrificans, produces hydrogen sulfide that reacts with the iron can to form black iron sulfide, without swelling. Putrefactive anaerobes produce gas and putrid odors, swelling the cans.

110. (B) It dictates that every hurdle applied must individually be lethal enough to sterilize the food.
Hurdle technology does not require each individual preservation factor to be lethal enough to sterilize the food. Instead, it relies on combining multiple sub-lethal factors. These factors work synergistically to disrupt microbial homeostasis. This approach achieves microbial stability while preserving the nutritional and sensory quality of the food product.

111. (A) Both A and R are true and R is the correct explanation of A.
The growth of Aspergillus flavus on stored peanuts is a severe food safety concern because this mould synthesizes aflatoxins. Aflatoxins are highly toxic secondary metabolites that are hepatotoxic, mutagenic, and among the most potent naturally occurring carcinogens known. Therefore, preventing Aspergillus growth during storage is critical to avoid peanut contamination.

112. (A) The breakdown of organic substances by microorganisms to produce energy, typically under anaerobic conditions, yielding products like organic acids or alcohol.
In food science, fermentation is the biochemical breakdown of organic substances, primarily carbohydrates, by microorganisms to generate energy. This metabolic process typically occurs under anaerobic conditions. It yields beneficial end-products such as organic acids, ethanol, and

Downloaded from www.pdf.tube

carbon dioxide, which preserve the food, modify its texture, and develop characteristic flavors.

113. (C) Spoilage driven predominantly by salt-tolerant Staphylococcus aureus and aerobic moulds.
At a low-acid pH of six point five and a reduced water activity of zero point eight eight, most vegetative bacteria are inhibited. However, the high-oxygen environment selectively supports aerobic organisms. Under these conditions, the dominant spoilage microflora will consist of xerophilic, aerobic moulds and highly salt-tolerant, osmotolerant bacteria like Staphylococcus aureus.

114. (A) It degrades the peptidoglycan cell wall of Gram-positive bacteria, preventing late-blowing defect caused by Clostridium tyrobutyricum.
Lysozyme is an enzyme that hydrolyzes the beta-one-four glycosidic bonds in peptidoglycan, destroying the cell walls of Gram-positive bacteria. In cheese making, it is added to prevent the late-blowing defect. This defect is caused by the germination of Clostridium tyrobutyricum spores, which ferment lactate into butyric acid, carbon dioxide, and hydrogen.

115. (D) Swiss cheese - Propionibacterium freudenreichii
Propionibacterium freudenreichii is the critical starter bacterium used in Swiss cheese production. It ferments lactic acid into propionic acid, acetic acid, and carbon dioxide gas. The propionic acid contributes to the cheese's sweet, nutty flavor, while the carbon dioxide gas accumulates in pockets, forming the characteristic holes, or eyes.

116. (B) Proliferation of psychrotrophic anaerobes or facultative anaerobes like Clostridium or certain Enterobacteriaceae.
Vacuum-packaged smoked salmon has a high water activity of zero point nine six and a neutral pH of six point two. When stored under slight temperature abuse at ten degrees Celsius, this oxygen-free environment supports the growth of psychrotrophic anaerobes or facultative anaerobes, including Clostridium species or Enterobacteriaceae. These bacteria produce gas and foul odors.

117. (C) Physical slicing of the food structure
Implicit factors represent the physiological properties of the microorganisms themselves, such as cell division rates, bacteriocin production, and synergistic relationships. Conversely, physical slicing of the food is a mechanical processing step. This process alters the food's physical structure, representing a process-related or extrinsic change rather than an implicit microbial property.

118. (D) It results in significant loss of edible biomass, financial losses to producers, and increased costs of food disposal.
The economic significance of food spoilage lies in its substantial impact on the global food supply. It leads to a massive loss of edible biomass, reducing food security. For producers, retailers, and consumers, spoilage causes significant financial losses, which are compounded by the high costs associated with food waste management and disposal.

119. (A) Chemical reaction between the fruit acids and the metal of the can.
A hydrogen swell in canned fruit occurs through a non-microbial, chemical pathway. The high-acid environment of the fruit juice reacts directly with the exposed tin or iron of the metal can. This corrosion reaction releases hydrogen gas, which accumulates in the headspace and causes the can to swell, without any microbial contamination.

120. (B) High Pressure Processing (HPP)
High Pressure Processing is a non-thermal food preservation technique. It subjects liquid or solid foods to high hydrostatic pressure, typically between one hundred and eight hundred megapascals. This pressure inactivates vegetative pathogens and spoilage microorganisms by disrupting their cellular membranes and denaturing essential proteins, while preserving the food's nutrients and quality.

NODIA

121. (B) Adaptation to the new environment and synthesis of essential enzymes without cell division.
The lag phase of the bacterial growth curve is characterized by a temporary halt in cell division. During this phase, the population does not increase. Instead, the cells focus on adapting to the new chemical and physical environment, synthesizing essential RNA, structural proteins, and metabolic enzymes required for subsequent replication.

122. (A) I and III only
Blanching is a mild thermal process designed to inactivate deteriorative enzymes before freezing or canning. Chemical preservatives like benzoates

When added to a food system, these agents halt the transition of the population into the exponential log phase, resulting in a vastly extended lag phase or maintaining a constant viable population level over time.

84. (B) It causes synergistic inhibition of vegetative pathogens and spoilage flora, effectively extending shelf-life.
Applying multiple hurdles like low oxygen, reduced water activity, and refrigeration in ready-to-eat meats creates overlapping metabolic stress. While each factor might be sub-lethal individually, their combined effect synergistically disrupts microbial homeostasis. This inhibits the growth of vegetative pathogens and spoilage organisms, successfully extending the product's shelf-life.

85. (C) Kanji - Lactic acid fermentation of black carrots
Kanji is a traditional Indian fermented beverage produced through spontaneous lactic acid fermentation of black carrots or beetroot. Epiphytic lactic acid bacteria ferment the natural sugars, producing lactic acid that imparts a characteristic sour taste. Other products like shrikhand involve lactic acid curd, while kinema is an alkaline bacterial fermentation, not acetic acid.

86. (D) Starter culture failure due to lytic viral infection
Starter culture failure in cheese production is often caused by contamination with lytic bacteriophages. These viruses specifically infect and replicate within the host bacterial cells, such as Lactococcus species, causing them to lyse. This lysis halts lactic acid production, preventing the curd from acidifying properly and disrupting the cheese manufacturing process.

87. (A) Butyric acid
Heterofermentative lactic acid bacteria utilize the phosphoketolase pathway to metabolize hexoses, producing equimolar amounts of lactic acid, carbon dioxide, and ethanol or acetic acid. Butyric acid, conversely, is not a product of this pathway; it is synthesized by anaerobic spore-formers like Clostridium butyricum, making it an indicator of spoilage.

88. (B) It is an alkaline fermented soybean product primarily utilizing specialized Bacillus subtilis strains.
Kinema is a traditional fermented food popular in the Himalayan regions of India. It is an alkaline fermented soybean product driven by Bacillus subtilis strains. These bacteria hydrolyze soy proteins into peptides and amino acids, releasing ammonia that raises the pH, giving the product its characteristic sticky texture and strong ammoniacal flavor.

89. (B) Knowing that aciduric yeasts (e.g., Zygosaccharomyces) or moulds are the most likely survivors and spoilers at this pH.
Apple juice stored at room temperature has an acidic pH of three point five, which is highly inhibitory to most vegetative bacteria. At this acidity, the primary spoilage hazards are acid-tolerant, or aciduric, microorganisms. Yeasts like Zygosaccharomyces and certain moulds can survive and grow under these conditions, causing cloudiness, gas, and fermentation.

90. (A) The time required in minutes at a given temperature to destroy 90% of the target microorganism.
The D-value, or decimal reduction time, is a fundamental metric in thermal processing. It represents the exposure time, in minutes, required to reduce a specific microbial population by ninety percent, which is equivalent to a one-log reduction, at a constant temperature. It is a direct indicator of heat resistance.

91. (C) Stationary phase
The stationary phase of the microbial growth curve is reached when the rate of cell division equals the rate of cell death, resulting in a stable viable population. This phase is triggered by the depletion of essential nutrients and the accumulation of toxic metabolic waste products within the closed system of the food matrix.

92. (B) I, III and IV
Thermal death time is the duration required to destroy a specific number of microorganisms at a defined temperature. As processing temperatures increase, the thermal death time decreases. This data is critical for validating safe canning processes and is plotted on semi-logarithmic graphs to determine the Z-value, which measures thermal sensitivity.

Click Here to Buy book on Amazon

132. (B) Beer
Yogurt, sauerkraut, and kimchi are produced through lactic acid fermentation, where lactic acid bacteria ferment sugars into lactic acid. Beer, in contrast, is produced through alcoholic fermentation. In this process, yeasts, primarily Saccharomyces cerevisiae, ferment simple sugars from malted barley into ethanol and carbon dioxide, rather than lactic acid.

133. (C) The biochemical rate of cellular death is highly exponential and significantly exceeds the rate of cell division.
The death or decline phase of the microbial growth curve is reached when environmental conditions become unfavorable due to nutrient depletion and toxic waste accumulation. During this phase, the rate of cellular death is highly exponential and significantly exceeds any remaining cell division, causing a rapid decline in the number of viable vegetative cells.

134. (D) Enzymatic spoilage driven by endogenous polyphenol oxidase (PPO) activity.
The rapid browning of fresh-cut fruits without signs of microbial growth is a classic example of enzymatic spoilage. This browning is driven by endogenous polyphenol oxidase enzymes, which are released when cell membranes are damaged by cutting. The enzyme catalyzes the oxidation of phenolic compounds into quinones, which polymerize into dark melanin pigments.

135. (A) High Eh (Positive redox potential) - Selectively favours the rapid growth of strictly anaerobic bacteria
A positive oxidation-reduction potential, or high Eh, indicates an oxidizing environment with abundant oxygen. This condition selectively favors the growth of aerobic microorganisms, such as Pseudomonas or moulds. Strictly anaerobic bacteria, such as Clostridium species, are inhibited by oxygen and require a negative redox potential, or low Eh, to grow, making this statement incorrect.

136. (B) $t = D \times (\log N_0 - \log N_t)$
The first-order logarithmic destruction of microorganisms by heat is represented by a classic equation. In this formula, the heating time, t, is equal to the decimal reduction time, D, multiplied by the log difference between the initial population, N zero, and the surviving population, N t. This relationship forms the basis for calculating thermal processing times.

137. (A) I, III and IV
Yeasts are utilized in fermentation to produce ethanol, and moulds are aerobic rather than anaerobic, requiring oxygen to grow. Certain mould genera, like Aspergillus and Penicillium, synthesize toxic secondary metabolites known as mycotoxins. Additionally, both yeasts and moulds exhibit higher tolerance to low water activities compared to most vegetative bacteria.

138. (D) Statement I is incorrect but Statement II is correct.
Shelf-life determination does not rely on sensory evaluation alone; it requires microbiological and chemical testing. Conversely, challenge testing is a highly robust method used to validate product formulations. This test involves artificially inoculating the food with target pathogens to determine if the formulation can support their survival or growth over the storage period.

139. (A) P-III, Q-IV, R-I, S-II
Lactic acid preserves food by lowering the pH and providing a tart flavor. Ethanol acts as an intoxicant and antimicrobial agent in beverages. Diacetyl is a volatile diketone that provides the characteristic butter flavor in dairy products. Propionic acid contributes to the flavor and is responsible for the gas holes, or eyes, in Swiss cheese.

NODIA

140. (D) Viruses rapidly spoil food by utilizing carbohydrates to produce acid and gas.
Viruses are obligate intracellular parasites that lack metabolic machinery. They are completely incapable of replication, nutrient utilization, or metabolic activity outside a host cell. Therefore, they do not metabolize carbohydrates, produce acid or gas, or cause food spoilage. Foods serve merely as passive vehicles, carrying viral particles to infect a living host.

141. (A) Both A and R are true and R is the correct explanation of A.
Listeria monocytogenes is a significant foodborne pathogen in refrigerated, ready-to-eat foods. It is a psychrotrophic bacterium, meaning it can multiply at refrigeration temperatures of four degrees Celsius. This ability allows it to bypass cold storage barriers and proliferate to dangerous

(A) The mollusks synthesizing the toxic compounds as a defensive mechanism against ocean predators
(B) The prolonged exposure of marine mollusks to heavy metal pollution in local industrial runoffs
(C) Filter-feeding of mollusks on toxic dinoflagellates like Alexandrium spp.
(D) The rapid post-harvest bacterial degradation and spoilage of the harvested mollusk tissues

47. Match the marine biotoxin in List I with its primary source or associated illness in List II.
List I: (Marine biotoxin)
P. Ciguatoxin
Q. Domoic acid
R. Okadaic acid
S. Brevetoxin
List II: (Primary source or associated illness)
I. Amnesic shellfish poisoning (ASP)
II. Diarrhetic shellfish poisoning (DSP)
III. Neurotoxic shellfish poisoning (NSP)
IV. Reef fish (e.g., barracuda, snapper)
(A) P-I, Q-IV, R-III, S-II
(B) P-IV, Q-I, R-II, S-III
(C) P-IV, Q-II, R-I, S-III
(D) P-III, Q-I, R-II, S-IV

48. Which of the following defines Antimicrobial Resistance (AMR) in the context of foodborne pathogens?
(A) The physiological ability of a pathogen to survive the physical heat applied during standard pasteurization
(B) The natural competitive exclusion of pathogenic bacteria by beneficial probiotic organisms in the gut
(C) The physical protective barrier provided by extracellular biofilms against chemical sanitizers
(D) The acquired ability of a microbe to resist the effects of an antimicrobial agent

49. Which of the following is not a recognized biochemical mechanism of antimicrobial resistance in bacteria?
(A) Acceleration of host immune responses to clear the antibiotic
(B) Efflux pumps that actively export the therapeutic antibiotic out of the bacterial cell
(C) Enzymatic degradation or chemical modification of the active antibiotic compound
(D) Direct alteration of the antibiotic's target binding site within the bacteria

50. Consider the following statements regarding AMR transmission:
I. AMR genes can be transferred horizontally between different bacterial species via plasmids.
II. Commensal bacteria in the animal gut cannot act as a reservoir for AMR genes.
III. The use of sub-therapeutic antibiotics as growth promoters in livestock is a major driver of AMR.
IV. Conjugation, transformation, and transduction are all mechanisms of horizontal gene transfer.
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

51. Which of the following is an incorrect statement about Extended-Spectrum Beta-Lactamases (ESBLs) in foodborne pathogens?
(A) ESBL-producing bacteria are completely susceptible to cephalosporins
(B) They are commonly found in Enterobacteriaceae such as E. coli and Salmonella
(C) ESBLs are enzymes that hydrolyze the beta-lactam ring of certain antibiotics
(D) Food-producing animals can act as reservoirs for ESBL-producing strains

52. Which of the following correctly pairs the resistant pathogen with its common food or agricultural reservoir?
(A) Methicillin-Resistant Staphylococcus aureus (MRSA) - Freshly caught ocean fish
(B) Fluoroquinolone-resistant Campylobacter - Hydroponically grown lettuce
(C) Colistin-resistant E. coli - Deep-well aquifer water
(D) Vancomycin-Resistant Enterococci (VRE) - Intensive poultry and swine farming

53. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The "One Health" approach to AMR emphasizes that human health, animal health, and environmental health are strictly

Downloaded from www.pdf.tube

approach. Relying on literature or models alone is insufficient. Conducting real-time shelf-life testing combined with microbiological challenge studies under realistic storage conditions provides empirical data. This approach accurately tracks the growth of spoilage organisms and pathogens over time.

www.nodia.in

NODIA

CHAPTER 09

Foodborne Pathogens, Food Poisoning, Food-Borne Diseases and Antimicrobials

1. Which of the following best defines a foodborne disease outbreak according to standard epidemiological guidelines?
(A) The occurrence of two or more cases of similar illness from a common food
(B) A single case of foodborne illness caused by a highly virulent bacterial pathogen
(C) The presence of any pathogenic microorganism inside a commercial processing facility
(D) An isolated incidence of acute gastroenteritis with a confirmed clinical diagnosis

2. Match the classification of foodborne illness in List I with the corresponding etiological agent in List II.
List I: (Classification of foodborne illness)
P. Foodborne infection
Q. Foodborne intoxication
R. Toxin-mediated infection
S. Parasitic infection
List II: (Etiological agent)
I. Clostridium perfringens
II. Salmonella Enteritidis
III. Staphylococcus aureus
IV. Cryptosporidium parvum
(A) P-III, Q-II, R-IV, S-I
(B) P-I, Q-IV, R-II, S-III
(C) P-II, Q-III, R-I, S-IV
(D) P-II, Q-I, R-III, S-IV

3. Which of the following characteristics strictly differentiates a foodborne intoxication from a foodborne infection?
(A) The illness is caused by ingesting preformed toxins present in the food
(B) The pathogen must colonize the gastrointestinal tract to induce symptoms
(C) The incubation period is typically longer than 48 hours
(D) The disease can only be treated with broad-spectrum antibiotics

4. Which of the following statements regarding foodborne infections is correct?
(A) They are exclusively caused by gram-positive, spore-forming bacterial organisms
(B) Symptoms usually appear within 30 minutes of consuming the contaminated food product
(C) They cannot be transmitted through the fecal-oral route under typical conditions
(D) They require the ingestion of viable microorganisms that multiply in the host

5. Consider the following statements regarding the differences between infections and intoxications:
I. Intoxications generally have a shorter incubation period than infections.
II. Heat treatment of food immediately before consumption always prevents intoxications.
III. Fever is a more common clinical feature in foodborne infections than in intoxications.
IV. Toxin-mediated infections require the ingestion of live bacteria that produce toxins in the gut.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

6. Which of the following is an incorrect statement concerning toxin-mediated infections?
(A) The pathogen produces toxins while growing in the human intestinal tract
(B) Clostridium perfringens is a classic example of an organism causing this type of illness
(C) Ingestion of the preformed toxin in the food is the primary cause of illness
(D) A relatively high infectious dose is usually required to establish the disease

7. Which of the following correctly pairs the pathogen with its primary reservoir in the food supply chain?
(A) Salmonella Typhi - Poultry gastrointestinal

Click Here to Buy book on Amazon

tracts
(B) Listeria monocytogenes - Low-acid canned foods
(C) Staphylococcus aureus - Untreated irrigation water
(D) Campylobacter jejuni - Raw milk and poultry

8. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Salmonella infections are frequently associated with the consumption of raw or undercooked eggs.
Reason (R): Salmonella Enteritidis can infect the ovaries of healthy-appearing hens, contaminating the egg contents before the shell is formed.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

9. Which of the following is an incorrect pair regarding the transmission route of foodborne pathogens?
(A) Vibrio cholerae - Fecal-contaminated drinking water supplies
(B) Bacillus cereus - Cross-contamination from raw poultry
(C) Norovirus - Infected food handlers preparing ready-to-eat foods
(D) Toxoplasma gondii - Undercooked commercial pork or game meat

10. All of the following are clinical features typically associated with non-typhoidal Salmonellosis, except:
(A) Acute abdominal cramps
(B) Flaccid paralysis
(C) Severe watery diarrhea
(D) High body fever

11. Arrange the following events in the chronological sequence of a typical foodborne Salmonella pathogenesis:
1. Invasion of the intestinal mucosal cells
2. Ingestion of contaminated food
3. Multiplication within macrophages
4. Survival through the acidic environment of the stomach
5. Induction of the inflammatory response leading to diarrhea

(A) 2, 4, 1, 3, 5
(B) 2, 1, 4, 5, 3
(C) 4, 2, 1, 3, 5
(D) 2, 4, 3, 1, 5

12. Which of the following is the most appropriate control measure to prevent Campylobacter contamination in a commercial poultry processing plant?
(A) Implementing strict cold chain maintenance at 4°C
(B) Administering prophylactic antibiotics to flocks one week before slaughter
(C) Utilizing hyper-chlorinated water in the immersion chilling tanks
(D) Vacuum packaging the final retail poultry products

13. A Food Safety Officer inspecting a dairy farm notices that raw milk is being sold directly to consumers. To assess the risk of Campylobacter jejuni transmission, the officer should primarily investigate which competency?
(A) The somatic cell count of the bulk milk pool in the storage tanks
(B) The presence of chemical aflatoxin M1 residues in the animal feed
(C) The use of modified atmosphere packaging for commercial dairy products
(D) The farm's pasteurization and sanitation practices

14. Read the given statements and select the correct option.
Statement I: Campylobacter species are highly resistant to environmental stresses such as drying and freezing.
Statement II: Campylobacter jejuni is a microaerophilic organism that requires reduced oxygen levels for optimal growth.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

15. A local hospital reports an outbreak of bloody diarrhea and hemolytic uremic syndrome (HUS) predominantly affecting children. The epidemiological investigation links the outbreak to undercooked ground beef patties at a fast-food chain. Which pathogen is the most likely causative agent?

Downloaded from www.pdf.tube

(A) Staphylococcus aureus
(B) Escherichia coli O157:H7
(C) Clostridium perfringens
(D) Vibrio parahaemolyticus

16. What physiological characteristic of Escherichia coli O157:H7 makes it particularly challenging to control in acidic food matrices like fermented sausages or unpasteurized apple cider?
(A) Its ability to form highly resistant endospores
(B) Its capacity to produce copious amounts of extracellular polymeric substances
(C) Its strict requirement for anaerobic conditions to survive
(D) Its extreme acid tolerance response allowing survival at low pH

17. Match the pathogenic E. coli strains in List I with their characteristic clinical features or mechanisms in List II.
List I: (Pathogenic E. coli strains)
P. Enterotoxigenic E. coli (ETEC)
Q. Enteropathogenic E. coli (EPEC)
R. Enterohemorrhagic E. coli (EHEC)
S. Enteroinvasive E. coli (EIEC)
List II: (Clinical features or mechanisms)
I. Attaching and effacing lesions, common in pediatric diarrhea
II. Produces Shiga-like toxins causing HUS
III. Invades colonic epithelial cells causing dysentery-like illness
IV. Produces heat-labile and heat-stable enterotoxins (Traveler's diarrhea)
(A) P-IV, Q-I, R-II, S-III
(B) P-IV, Q-II, R-I, S-III
(C) P-I, Q-IV, R-III, S-II
(D) P-II, Q-III, R-IV, S-I

18. The ability of Listeria monocytogenes to grow at refrigeration temperatures is a direct effect of which cellular adaptation?
(A) The rapid production of protective heat-shock proteins to maintain cellular enzyme stability
(B) The spontaneous formation of protective endospores immediately upon exposure to cold
(C) An increase in branched-chain fatty acids within its cell membrane
(D) A metabolic shift from standard aerobic respiration to obligate anaerobic fermentation

19. Which of the following defines "listeriosis" in the context of foodborne public health?
(A) A severe systemic infection affecting mainly high-risk patient populations
(B) A mild, self-limiting gastroenteritis frequently observed in healthy young adults
(C) An acute foodborne intoxication caused by the ingestion of preformed listeriolysin O in dairy products
(D) A chronic gastrointestinal disease resulting from long-term dietary exposure to Listeria innocua

20. Consider the following statements about Listeria monocytogenes:
I. It is a gram-positive, non-spore-forming rod.
II. It exhibits tumbling motility at room temperature but not at 37°C.
III. It cannot survive in environments with high salt concentrations.
IV. It is an intracellular pathogen that uses actin polymerization to move between host cells.
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

21. Which of the following statements about Staphylococcus aureus food poisoning is correct?
(A) The resulting illness must be treated primarily with targeted broad-spectrum antibiotics
(B) The enterotoxins are highly heat-resistant and survive normal cooking
(C) Clinical symptoms usually take 48 to 72 hours to fully develop after food consumption
(D) Staphylococcus aureus competes exceptionally well with other natural microbiota in raw foods

22. Which of the following is an incorrect statement regarding the control of Staphylococcus aureus in food?
(A) Rapid cooling of cooked foods prevents the multiplication of the organism
(B) Food handlers are a major source of contamination due to the organism's presence in the nasal cavity
(C) High osmotic pressure (e.g., in cured meats) effectively inhibits the growth of S. aureus
(D) Proper temperature maintenance in hot holding buffets is crucial to prevent enterotoxin production

NODIA

23. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Reheating food to 74°C ($165^{\circ}F$) guarantees the safety of food previously contaminated with large numbers of Staphylococcus aureus.
Reason (R): Staphylococcus aureus vegetative cells are destroyed by standard reheating temperatures.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

24. A characteristic feature of Clostridium botulinum is its ability to produce a potent neurotoxin. The primary mechanism of action of this toxin is:
(A) Blocking the release of acetylcholine at the neuromuscular junction
(B) Overstimulating the production of cyclic AMP in intestinal cells
(C) Inhibiting protein synthesis by inactivating the 60S ribosomal subunit
(D) Causing irreversible damage to the mucosal lining of the stomach

25. A food safety inspector investigates an outbreak of botulism linked to home-canned green beans. Which critical error in the home-canning process most likely led to this outbreak?
(A) Adding excessively high concentrations of acetic acid or vinegar to the canning liquid
(B) Processing low-acid foods in a boiling water bath instead of a pressure canner
(C) Storing the sealed glass jars in a dark, cool kitchen pantry instead of a refrigerator
(D) Failing to wash and sanitize the raw green beans properly prior to thermal processing

26. Which of the following correctly pairs the Clostridium botulinum toxin type with its most common associated source?
(A) Type E - Non-proteolytic strains commonly found in processed meats
(B) Type A - Proteolytic strains in home-canned vegetables
(C) Type B - Marine environments and commercially fermented fish
(D) Type F - Infant botulism cases specifically associated with honey

27. Which of the following is not an exception to the strict anaerobic requirement of Clostridium species?
(A) C. botulinum spores can germinate in highly oxygenated surface environments
(B) C. perfringens can tolerate brief exposures to oxygen
(C) C. histolyticum exhibits aerotolerant growth capabilities
(D) Some Clostridium species can survive in microaerophilic pockets within food matrices

28. According to the standard 12D process used in the canning industry, what is the primary objective when designing thermal processes for low-acid canned foods?
(A) Achieving a targeted 12-log reduction of highly active Clostridium perfringens vegetative cells
(B) Ensuring the complete thermal destruction of all resistant thermophilic spoilage organisms
(C) Reducing Clostridium botulinum spore survival probability to 1 in 10^{12} cans
(D) Maintaining the original nutritional profile of the food by limiting heat exposure to exactly 12 minutes

29. As a Food Safety Officer assessing a large-scale catering operation, you notice cooked gravies being left at room temperature for 6 hours before service. This practice is most likely to cause an outbreak of which pathogen?
(A) Listeria monocytogenes
(B) Shigella dysenteriae
(C) Hepatitis A virus
(D) Clostridium perfringens

30. Read the given statements and select the correct option.
Statement I: Clostridium perfringens causes food poisoning primarily through the ingestion of preformed enterotoxin in the food.
Statement II: The C. perfringens enterotoxin (CPE) is typically produced during the sporulation of the bacteria in the lower intestinal tract.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

Click Here to Buy book on Amazon

31. Arrange the steps involved in the pathogenesis of Clostridium perfringens food poisoning in the correct sequence:
1. Sporulation of bacteria in the small intestine
2. Ingestion of a large number of viable vegetative cells
3. Release of enterotoxin alongside the mother cell lysis
4. Temperature abuse of cooked meat allows spores to germinate and multiply
5. Toxin binds to intestinal epithelial cells causing fluid loss

(A) 2, 4, 1, 3, 5
(B) 4, 2, 1, 3, 5
(C) 4, 1, 2, 3, 5
(D) 2, 1, 4, 3, 5

32. Match the Bacillus cereus illness syndrome in List I with its associated characteristics in List II.
List I: (Bacillus cereus illness syndrome)
P. Emetic syndrome
Q. Diarrhoeal syndrome
R. Cereulide toxin
S. Enterotoxin (HbL, Nhe)
List II: (Associated characteristics)
I. Heat-labile, produced in the intestine
II. Associated with proteinaceous foods and vegetables
III. Heat-stable, preformed in food
IV. Associated heavily with fried rice and starchy foods
(A) P-III, Q-I, R-IV, S-II
(B) P-IV, Q-I, R-III, S-II
(C) P-II, Q-IV, R-I, S-III
(D) P-IV, Q-II, R-III, S-I

33. Which of the following is the most appropriate action to prevent the emetic syndrome caused by Bacillus cereus in a commercial kitchen?
(A) Cooling cooked rice to below 5°C and storing it refrigerated
(B) Storing the cooked rice at an intermediate warm holding temperature of 40°C
(C) Reheating any leftover rice to at least 75°C to destroy the preformed toxin
(D) Washing the raw agricultural rice thoroughly with hot water prior to cooking

34. A food handler mistakenly leaves a large pot of boiled rice on the counter overnight. The next day, the rice is briefly heated and served. Several customers develop severe nausea and vomiting within 2 hours. This case best illustrates the application of which microbiological concept?
(A) Post-processing contamination by enteric viruses during subsequent food handling steps
(B) Colonization of the human intestinal tract by an opportunistic psychrotrophic pathogen
(C) Spore germination and subsequent production of a heat-stable toxin
(D) Cross-contamination of cooked ready-to-eat food by raw meat processing exudates

NODIA

35. Consider the following statements about Vibrio cholerae:
I. It is a halophilic organism that absolutely requires high salt concentrations for survival.
II. The O1 and O139 serogroups are primarily responsible for epidemic cholera.
III. Cholera toxin is an A-B type enterotoxin that causes massive secretory diarrhea.
IV. Transmission is predominantly linked to the consumption of fecally contaminated water and raw seafood.
(A) II, III, and IV
(B) I, II, and III
(C) I, III, and IV
(D) I, II, and IV

36. Which of the following is an incorrect statement regarding Vibrio parahaemolyticus?
(A) It is a common cause of seafood-associated gastroenteritis worldwide
(B) The production of Thermostable Direct Hemolysin (TDH) is closely correlated with its pathogenicity
(C) Its growth is completely inhibited by thorough cooking of seafood
(D) It is highly resistant to freezing, meaning frozen storage of seafood increases its viable counts

37. Which of the following correctly pairs the viral agent with its primary mode of transmission in the food industry?
(A) Hepatitis A - Airborne transmission from contaminated ventilation systems in food facilities
(B) Norovirus - Fecal-oral route, primarily via infected food handlers
(C) Rotavirus - Ingestion of undercooked pork products from infected swine operations
(D) Hepatitis E - Consumption of unpasteurized dairy products from local cow farms

38. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Routine bacteriological testing of food for indicator organisms like E. coli provides an accurate direct measure of Norovirus contamination.
Reason (R): Norovirus and E. coli share identical environmental survival characteristics and response to sanitizers.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

39. Which of the following is an incorrect pair concerning the characteristics of Hepatitis A virus (HAV)?
(A) Pathogenesis - Multiplies in the liver causing jaundice
(B) Nucleic acid - Single-stranded RNA
(C) Resistance - Highly resistant to low pH and freezing
(D) Incubation period - Typically 2 to 4 days

40. All of the following are true regarding Cryptosporidium and Giardia as waterborne protozoan pathogens, except:
(A) They are highly susceptible to standard municipal water chlorination
(B) They both form environmentally resistant cysts or oocysts to survive harsh conditions
(C) Their infectious doses are typically very low, often requiring fewer than 100 cysts/oocysts
(D) They cause prolonged diarrheal illness, particularly in highly immunocompromised individuals

41. Arrange the following steps in the lifecycle and transmission of Giardia lamblia in a waterborne outbreak context:
1. Ingestion of water contaminated with cysts
2. Excystation in the small intestine releasing trophozoites
3. Excretion of infectious cysts in feces
4. Multiplication of trophozoites via binary fission
5. Encystation as the parasites transit toward the colon

(A) 1, 4, 2, 5, 3
(B) 1, 2, 4, 5, 3
(C) 3, 1, 2, 4, 5
(D) 1, 2, 5, 4, 3

42. What is the most appropriate regulatory approach to managing the risk of aflatoxin contamination in peanuts?
(A) Mandating terminal high-heat sterilization of all raw peanuts prior to retail sale
(B) Establishing maximum allowable limits and conducting batch testing
(C) Banning the import of agricultural peanuts from tropical climates entirely
(D) Requiring the use of chemical antifungal sprays on the final packaged product

43. A food safety analyst detects elevated levels of ochratoxin A in a shipment of coffee beans. Which competency must the analyst apply to correctly trace the source of this contamination?
(A) Identifying improper storage conditions that allow fungal growth
(B) Testing the imported coffee beans for residual synthetic chemical pesticides
(C) Analyzing the industrial roasting process for inadequate Maillard reaction temperatures
(D) Swabbing the internal surfaces of the processing equipment for bacterial biofilms

44. Read the given statements and select the correct option.
Statement I: Fumonisins are a group of my mycotoxins primarily produced by Fusarium species.
Statement II: Fumonisin B1 is commonly associated with corn and has been linked to esophageal cancer in humans.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

45. A coastal community reports an outbreak of numbness, tingling of the lips and tongue, and respiratory distress after consuming locally harvested clams during a “red tide” event. This case indicates an outbreak of:
(A) Amnesic shellfish poisoning (ASP)
(B) Ciguatera fish poisoning
(C) Histamine (scombroid) poisoning
(D) Paralytic shellfish poisoning (PSP)

46. The accumulation of saxitoxin in bivalve mollusks is a direct cause and effect of:

Downloaded from www.pdf.tube

levels over extended storage times, presenting a major risk to public health.

142. (B) A thermal process applied to low-acid canned foods to achieve a 12-log reduction of Clostridium botulinum spores.
The twelve-D concept is a thermal sterilization standard for low-acid canned foods. It refers to a process designed to achieve a twelve-log reduction in the population of Clostridium botulinum spores. This process reduces the probability of spore survival to one in one trillion cans, ensuring public safety against botulism.

143. (D) The microbial growth rate will decrease significantly, thereby substantially extending the product's shelf-life.
Lowering the storage temperature of milk from ten to four degrees Celsius downregulates microbial enzyme kinetics. According to temperature-dependence principles in predictive microbiology, this reduction in metabolic activity significantly decreases the microbial growth rate. Slowing this rate extends the lag phase, delaying exponential growth and substantially extending the shelf-life of the dairy product.

144. (A) It causes exposure of nutrient-rich internal tissues to ambient flora, resulting in rapid microbial proliferation and spoilage.
A physical barrier, such as fruit skin or an eggshell, protects inner tissues from microbial contamination. Rupturing this barrier exposes the nutrient-rich, high-moisture internal tissues to environmental microflora. This exposure allows rapid colonization and proliferation of bacteria, yeasts, and moulds, leading to accelerated enzymatic and microbial food spoilage post-harvest.

145. (C) Log phase - Exponential growth and active metabolism
The log, or exponential, phase of the microbial growth curve is characterized by rapid, unrestricted cell division. During this phase, cells divide at a constant, maximum rate under the given conditions, and metabolic activity is highly active. Other phases, such as lag, stationary, and death, represent different stages of population dynamics and physiological states.

146. (A) Accidental contamination and aerobic growth of Acetobacter converting valuable ethanol into sour acetic acid.
Leaving wine in unsealed barrels exposes the liquid to oxygen and airborne contaminants. Under these aerobic conditions, acetic acid bacteria like Acetobacter can colonize the surface, forming a pellicle. These bacteria oxidize the ethanol in the wine into acetic acid and ethyl acetate, producing a sour, vinegar-like off-flavor and spoiling the product.

147. (D) Modifying the food formulation to contain 10% salt.
Extrinsic parameters are environmental conditions external to the food, such as temperature, relative humidity, and atmospheric gas concentrations. Conversely, modifying the food formulation by adding salt directly alters the food's internal chemical composition and lowers its water activity. This modification represents an intrinsic parameter rather than an extrinsic control method.

148. (B) Protozoa like Cryptosporidium and Giardia are primarily transmitted via contaminated water and poor food handler hygiene.
Protozoa are single-celled eukaryotic parasites that cannot replicate within food matrices. Pathogens like Cryptosporidium and Giardia are transmitted as infective cysts through contaminated water or poor hygiene by food handlers. These cysts are highly resistant to environmental stress and cause severe gastrointestinal infections in humans upon ingestion.

NODIA

149. (C) Predictive models provide estimates; actual challenge testing and real-time shelf-life studies must validate the 30-day claim for RTE products.
Predictive microbiology models use mathematical equations to estimate microbial growth based on environmental parameters. However, these models are simplified estimates. For complex, ready-to-eat products, manufacturers must validate these predictions with wet-laboratory challenge testing and real-time shelf-life studies. This testing ensures safety against pathogens like Listeria under realistic storage conditions.

150. (D) Conducting real-time shelf-life testing coupled with active microbiological challenge studies under realistic environmental storage conditions.
Determining the precise expiration date of a perishable dairy beverage requires a comprehensive

separate domains.
Reason (R): AMR genes exclusively evolve in human clinical settings and rarely cross over into agricultural environments.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) Both A and R are false.

54. Which of the following is an incorrect pair regarding AMR detection methods?
(A) Disc diffusion - Measures the zone of inhibition on agar plates
(B) Minimum Inhibitory Concentration (MIC) - Determines the lowest concentration of antimicrobial that visibly inhibits growth
(C) Polymerase Chain Reaction (PCR) - Phenotypically assesses the survival of bacteria in varying antibiotic broth dilutions
(D) Whole Genome Sequencing (WGS) - Identifies the specific AMR genes present in the bacterial DNA

55. All of the following are primary routes by which water serves as a transmission vector for AMR, except:
(A) Direct discharge of untreated municipal hospital wastewater into local rivers
(B) Surface runoff from intensive agricultural lands using animal manure as fertilizer
(C) Continuous infiltration of intensive aquaculture effluents into local watersheds
(D) Evaporation of water into the atmosphere forming sterile rain

56. Based on phenotypic testing, a Salmonella isolate is reported to have a High MIC for ciprofloxacin. What is the most appropriate interpretation of this result?
(A) The isolate is resistant, meaning standard doses of ciprofloxacin may fail
(B) The isolate physiologically requires a high concentration of ciprofloxacin for its growth
(C) The isolate is highly susceptible to very low clinical doses of the drug ciprofloxacin
(D) Ciprofloxacin cannot be used under any clinical circumstances for any bacterial infection

57. As an FSO, you are tasked with developing an AMR surveillance plan for retail meats. Which competency is essential for the valid execution of this plan?
(A) Ensuring all retail samples are thoroughly cooked prior to performing microbiological analysis
(B) Using standardized protocols and CLSI/ EUCAST guidelines for susceptibility testing
(C) Only testing for specific foodborne pathogens that show visible physical spoilage on the meat
(D) Disregarding critical commensal bacteria like generic E. coli in the final surveillance database

58. Read the given statements and select the correct option.
Statement I: Cross-contamination during food preparation can transfer AMR bacteria from raw meat to ready-to-eat salads.
Statement II: Proper cooking temperatures destroy AMR bacteria just as effectively as they destroy susceptible bacteria of the same species.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

59. A widespread outbreak of Listeriosis occurs across multiple states. Epidemiological trace-back points to a single cheese manufacturing facility. Which surveillance and reporting system would have been most crucial in identifying this multi-state linkage through molecular subtyping?
(A) PulseNet
(B) The National Health and Nutrition Examination Survey (NHANES)
(C) FoodNet (solely based on active surveillance interviews)
(D) The local municipal water quality monitoring database

60. The concept of competitive exclusion as a prevention strategy against foodborne pathogens in poultry involves:
(A) Vaccinating the production birds with a live genetically modified viral strain to boost immunity
(B) Using low-dose sub-therapeutic antibiotics in feed to completely eliminate all gut bacteria
(C) Administering beneficial gut microflora to chicks to prevent Salmonella colonization
(D) Exposing the finished dry poultry feed to intensive gamma irradiation processes

Click Here to Buy book on Amazon

123. The definition of the "D-value" incorporates which of the following mathematical concepts?
(A) The negative reciprocal of the slope when log survivors are plotted against time
(B) The maximum exponential growth rate of a bacterial population during its active log phase
(C) The complete mathematical integral of the area under the thermal death time curve
(D) The standard deviation of the measured generation time of a specific target pathogen

124. Which of the following is a correct statement regarding Campylobacter transmission?
(A) It is primarily transmitted through the consumption of improperly canned vegetables
(B) It is highly resistant to chlorination, making municipal water the most common vehicle
(C) Cross-contamination from raw poultry to ready-to-eat foods is a major risk factor
(D) The organism readily multiplies in raw meat stored at refrigeration temperatures

125. Consider the following statements about the surveillance of AMR:
I. Surveillance helps in monitoring trends in resistance over time.
II. It is essential for updating empirical treatment guidelines for foodborne illnesses.
III. Retail meat sampling is a critical component of tracking AMR in the food chain.
IV. Phenotypic data alone is sufficient to track the spread of specific resistance plasmids globally.
(A) I, III, and IV
(B) II, III, and IV
(C) I, II, and IV
(D) I, II, and III

126. Which of the following is an incorrect statement concerning the survival of foodborne pathogens?
(A) Salmonella can survive for months in dry environments like powdered infant formula
(B) Listeria monocytogenes can survive high salt concentrations (up to 10% NaCl)
(C) Vibrio cholerae thrives in fresh, highly acidic water sources
(D) Staphylococcus aureus is highly resistant to desiccation

127. Which of the following correctly pairs the intrinsic factor with its definition?
(A) pH - The overall concentration of free hydrogen ions measured within the food matrix
(B) Water activity (a_w) - The ratio of the food's vapor pressure to that of pure water
(C) Redox potential (Eh) - The relative ease with which the food substrate loses or gains electrons
(D) Antimicrobial constituents - Natural chemical substances in food that inhibit microbial growth

128. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The use of strict anaerobic packaging (like vacuum sealing) eliminates the risk of all foodborne pathogens.
Reason (R): Pathogens like Clostridium botulinum are obligate anaerobes and are stimulated by the removal of oxygen.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

129. Which of the following is an incorrect pair concerning the symptoms of foodborne illnesses?
(A) Clostridium perfringens - High fever and bloody stools
(B) Bacillus cereus (emetic) - Vomiting and nausea
(C) Clostridium botulinum - Double vision and difficulty swallowing
(D) Listeria monocytogenes - Meningitis in immunocompromised patients

130. All of the following are recognized modes of action for antimicrobial agents used in human and veterinary medicine, except:
(A) Inhibition of cell wall synthesis
(B) Inhibition of protein synthesis via ribosomal binding
(C) Acceleration of bacterial flagellar motility
(D) Interference with nucleic acid synthesis

131. Arrange the following steps in the standard procedure for performing an Antimicrobial Susceptibility Test using the Disc Diffusion method:
1. Incubate the plates for 16-18 hours at the

NODIA

outside the host.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

69. Which of the following is an incorrect pair concerning the growth requirements of pathogens?
(A) Campylobacter jejuni - Strict microaerophilic gas atmosphere
(B) Clostridium botulinum - Growth at pH of 4.2
(C) Staphylococcus aureus - Minimum water activity of 0.86
(D) Listeria monocytogenes - Standard psychrotrophic growth

70. All of the following are potential sources of Salmonella contamination in agriculture, except:
(A) Routine use of untreated biological soil amendments of animal origin on fields
(B) Migratory wild birds roosting directly above open surface irrigation canals
(C) The internal tissues of an intact, healthy apple
(D) Contaminated transport vehicles moving directly between commercial poultry farms

71. Arrange the following foodborne illness investigation phases in the correct sequence according to standard epidemiological practices:
1. Formulate a hypothesis regarding the source
2. Implement control and prevention measures
3. Verify the diagnosis and confirm the outbreak
4. Conduct an analytical study (e.g., case-control study)
5. Define and identify cases

(A) 1, 3, 5, 2, 4
(B) 5, 3, 1, 4, 2
(C) 3, 1, 5, 4, 2
(D) 3, 5, 1, 4, 2

72. The most appropriate initial step for a food facility immediately following notification that their product is linked to an outbreak of E. coli O157:H7 is to:
(A) Initiate a voluntary product recall and halt distribution
(B) Wait for whole genome sequencing results before taking action
(C) Increase the cooking temperature recommendations on their packaging
(D) Fire the quality assurance manager

NODIA

73. A food processing plant implements a new sanitation protocol to control Listeria monocytogenes in their floor drains. Which competency is required to effectively validate this new protocol?
(A) Visually inspecting the surface of floor drains for any signs of physical soil or debris
(B) Conducting environmental swabbing for Listeria before and after sanitation
(C) Testing the final finished food product for unrelated pathogens like Staphylococcus aureus
(D) Reviewing the chemical manufacturing supplier's marketing and product brochures

74. Read the given statements and select the correct option.
Statement I: Marine biotoxins like saxitoxin are heat stable and cannot be destroyed by normal cooking.
Statement II: Red tides are universally predictable, allowing continuous safe harvesting of shellfish year-round.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

75. A patient develops watery diarrhea and profound dehydration within 24 hours of returning from an international trip where they consumed untreated street water. A stool sample reveals curved, gram-negative rods that exhibit characteristic "shooting star" motility. Which organism is most likely responsible?
(A) Vibrio cholerae
(B) Shigella sonnei
(C) Listeria monocytogenes
(D) Hepatitis A

76. The cause and effect relationship in infant botulism primarily revolves around:
(A) Ingestion of preformed toxic compounds in pureed baby meats causing rapid flaccid paralysis
(B) Direct transplacental transfer of active botulinum toxin from mother to fetus during pregnancy

61. Arrange the hierarchy of control strategies for preventing foodborne illness in a commercial kitchen from most fundamental to most specific:
1. Implementing HACCP plans for specific critical control points
2. Ensuring personal hygiene and basic handwashing
3. Conducting molecular pathogen testing on end products
4. Establishing standard sanitation operating procedures (SSOPs)

(A) 1, 2, 4, 3
(B) 4, 2, 1, 3
(C) 2, 1, 4, 3
(D) 2, 4, 1, 3

62. Match the prevention strategy in List I with the targeted pathogen or condition in List II.
List I: (Prevention strategy)
P. Maintaining pH below 4.6
Q. Thoroughly cooking pork to 71°C
R. Rapid chilling of large meat joints
S. Avoiding raw oysters
List II: (Targeted pathogen or condition)
I. Vibrio vulnificus
II. Clostridium botulinum (spore germination)
III. Trichinella spiralis / Yersinia enterocolitica
IV. Clostridium perfringens
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-IV, R-III, S-I
(C) P-II, Q-III, R-IV, S-I
(D) P-IV, Q-III, R-II, S-I

63. Which of the following best defines the 'One Health' approach in the context of food safety?
(A) A localized clinical policy that focuses entirely on human medical treatments to cure foodborne diseases
(B) An approach recognizing the interconnection between people, animals, plants, and their environment
(C) A global green initiative strictly dedicated to reducing chemical synthetic pesticide use in agriculture
(D) A rigid regulatory framework that applies a single global manufacturing standard for food packaging

64. Which of the following is a correct statement regarding mycotoxins in the food supply?
(A) They are readily and completely destroyed by normal boiling temperatures used in household cooking
(B) They are exclusively found in fresh, high-moisture agricultural fruits and leafy green crops
(C) They cause rapid-onset, acute gastrointestinal distress within minutes of initial food consumption
(D) They are toxic fungal metabolites produced under specific conditions

65. Consider the following statements about Ciguatera fish poisoning:
I. It is caused by consuming reef fish that have accumulated ciguatoxins.
II. The toxins originate from benthic dinoflagellates, such as Gambierdiscus toxicus.
III. Ciguatoxins are easily deactivated by freezing the fish prior to cooking.
IV. A hallmark symptom is the reversal of hot and cold temperature sensation.
(A) I, II, and IV
(B) I, II, and III
(C) II, III, and IV
(D) I, III, and IV

66. Which of the following is an incorrect statement regarding Norovirus?
(A) It is recognized as the leading viral cause of acute epidemic gastroenteritis globally
(B) It has an extremely low infectious dose, often requiring fewer than 100 infectious particles
(C) It has a lipid envelope, making it highly susceptible to alcohol sanitizers
(D) Human immunity to the virus is typically short-lived and strictly strain-specific

67. Which of the following correctly pairs the mycotoxin with its major target organ for toxicity in humans?
(A) Fumonisin B1 - Neural tube/Esophagus
(B) Aflatoxin B1 - Hepatic liver tissue
(C) Ochratoxin A - Renal kidney organs
(D) Zearalenone - Reproductive tract

68. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The presence of generic E. coli in drinking water is a definitive indicator of recent fecal contamination.
Reason (R): E. coli is a natural inhabitant of the intestinal tract of warm-blooded animals and typically does not survive for extended periods

Downloaded from www.pdf.tube

Reason (R): Sub-lethal concentrations of antimicrobials create selective pressure, allowing bacteria possessing resistance genes to survive and proliferate.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

84. Which of the following correctly pairs the food processing parameter with its primary lethal effect on microorganisms?
(A) Ultra-High Temperature (UHT) processing - Cellular dehydration
(B) High hydrostatic pressure - Oxidation of cell wall lipids
(C) Lyophilization - Denaturation of structural proteins
(D) Gamma irradiation - DNA damage and strand breakage

85. All of the following are primary components of a comprehensive national AMR surveillance system, except:
(A) Monitoring antimicrobial usage in both human medicine and agriculture
(B) Mandating the exclusive use of traditional herbal remedies in livestock
(C) Tracking the resistance profiles of indicator bacteria from food-producing animals
(D) Collecting data on the clinical outcomes of resistant infections in humans

86. What is the fundamental mechanism by which Staphylococcus aureus enterotoxins cause severe vomiting?
(A) They cause widespread severe inflammatory necrosis of the delicate human intestinal villi
(B) They directly paralyze the smooth muscle layers throughout the entire gastrointestinal tract
(C) They act as superantigens that stimulate vagus nerve endings in the stomach
(D) They induce the active secretion of massive amounts of fluid and electrolytes into the colon

87. Which is the most appropriate indicator of time-temperature abuse in a batch of fresh scombroid fish (e.g., tuna)?
(A) High levels of trimethylamine oxide (TMAO)
(B) The presence of domoic acid
(C) High counts of Clostridium botulinum spores
(D) Elevated concentrations of histamine

88. If a Food Safety Officer wants to evaluate the potential for Staphylococcus aureus enterotoxin production in a fermented sausage, which competency must they apply?
(A) Assessing pH decline relative to temperature during fermentation
(B) Measuring the precise concentration of residual chemical nitrites at the end of curing processes
(C) Testing the external fibrous casing for the microscopic presence of visible mold growth
(D) Quantifying the total volatile basic nitrogen (TVBN) compounds as an indicator of spoilage

89. Read the given statements and select the correct option.
Statement I: Hepatitis A is frequently transmitted by the consumption of bivalve mollusks harvested from polluted waters.
Statement II: Bivalve mollusks filter large volumes of water and can concentrate viral particles in their tissues.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

90. A farm worker accidentally applies raw, uncomposted manure to a field of spinach just days before harvest. This action most significantly increases the risk of an outbreak involving:
(A) Vibrio parahaemolyticus
(B) Escherichia coli O157:H7
(C) Aspergillus flavus
(D) Clostridium botulinum Type E

91. The cause and effect relationship between the consumption of undercooked pork and Trichinellosis is based on:
(A) Ingestion of encysted larvae that mature in the gut and migrate to muscle
(B) Ingestion of highly toxic preformed bacterial compounds inside the raw muscle tissue
(C) The direct horizontal transfer of resistant genes from the swine microbiome to human gut flora
(D) The gradual bioaccumulation of toxic heavy

NODIA

II. 1 to 7 hours
III. 15 to 50 days
IV. 1 to 4 weeks (or more)
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-III, R-I, S-IV
(D) P-IV, Q-I, R-III, S-II

108. The phenomenon where a non-pathogenic bacterial strain acquires a Shiga toxin gene via a bacteriophage, transforming it into a pathogen, is a clear effect of:
(A) Transformation
(B) Conjugation
(C) Transduction
(D) Transposon mutagenesis

109. Which of the following defines the term "cross-resistance" in antimicrobial therapy?
(A) A bacterial cell is genetically resistant to multiple structurally unrelated antibiotics
(B) The physiological ability of a pathogen to survive both antibiotics and heavy metal exposure
(C) The direct physical crossing and transmission of resistant bacteria from one animal to another
(D) Resistance to one agent confers resistance to others in the same class

110. Consider the following statements about MRSA (Methicillin-Resistant Staphylococcus aureus) in the food chain:
I. Livestock-associated MRSA (LA-MRSA) is increasingly found in swine and poultry.
II. Foodborne transmission of MRSA is the primary route of human MRSA infections.
III. The mecA gene is responsible for methicillin resistance by altering the penicillin-binding protein.
IV. Proper meat handling and cooking mitigate the risk of acquiring LA-MRSA from food.
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

111. Which of the following is a correct statement about the surveillance of foodborne diseases?
(A) Passive surveillance systems actively contact laboratories to find unreported cases
(B) Syndromic surveillance monitors health-related data (like pharmacy sales) to detect outbreaks early
(C) Most foodborne illnesses are reported to health departments, leading to highly accurate total case counts
(D) WGS is too expensive and slow to be used in modern national surveillance networks

112. Which of the following is an incorrect statement regarding the One Health approach?
(A) It recognizes that human health is linked to the health of animals and the environment
(B) It requires collaboration across multiple disciplines including veterinarians, doctors, and environmental scientists
(C) It addresses issues like zoonotic diseases, AMR, and food safety
(D) It advocates for the increased use of antibiotics in animals to ensure human food safety

113. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Freezing is an effective method to kill the cysts of Giardia lamblia and Cryptosporidium parvum in food.
Reason (R): The formation of intracellular ice crystals irreversibly damages the structural integrity of protozoan cysts.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

114. Which of the following correctly pairs the pathogen with its standard method of detection in water samples?
(A) Norovirus - Direct plating on standard selective MacConkey agar plates
(B) Salmonella - Chemical measurement of residual free chlorine in reservoirs
(C) Cryptosporidium - Filtration and immunofluorescence microscopy
(D) E. coli O157:H7 - Rapid turbidimetric assay in standard growth broth

115. All of the following factors contribute to the emergence of AMR in food systems, except:
(A) Implementing pre-slaughter withdrawal periods for veterinary drugs
(B) Highly inadequate wastewater treatment

Click Here to Buy book on Amazon

(D) A is false but R is true.

99. Which of the following is an incorrect pair regarding the natural habitat or source of foodborne pathogens?
(A) Staphylococcus aureus - Bovine intestinal tract
(B) Bacillus cereus - Soil and dust
(C) Vibrio vulnificus - Warm coastal waters
(D) E. coli O157:H7 - Ruminant gastrointestinal tract

100. All of the following are recognized mechanisms to delay or prevent the onset of antimicrobial resistance in the food chain, except:
(A) Implementing stringent biosecurity measures on farms to reduce infection rates
(B) Utilizing vaccines in livestock to prevent bacterial diseases
(C) Adopting precision agriculture and targeted treatments rather than mass medication
(D) Using antibiotics as standard growth promoters to ensure uniform animal size

101. Arrange the sequence of events leading to Ciguatera Fish Poisoning:
1. Consumption of toxic reef fish by humans
2. Bioaccumulation and biotransformation of toxins in carnivorous reef fish
3. Growth of Gambierdiscus toxicus on coral reefs
4. Grazing of herbivorous fish on toxic dinoflagellates

(A) 4, 3, 2, 1
(B) 3, 4, 2, 1
(C) 3, 2, 4, 1
(D) 2, 3, 4, 1

102. Which is the most appropriate regulatory standard for ensuring the safety of canned low-acid foods?
(A) Achieving a final processed food pH of exactly 5.0
(B) Adding exactly 0.1% chemical sodium benzoate preservative
(C) Ensuring an F_0 value of 3.0 minutes
(D) Processing at a temperature of 100°C for 10 minutes

103. A microbiologist isolating Campylobacter jejuni from a poultry swab must apply which specific competency regarding incubation?
(A) Incubating the isolation agar plates aerobically at a constant temperature of 25°C
(B) Incubating the isolation agar plates anaerobically at a constant temperature of 37°C
(C) Incubating the isolation agar plates aerobically inside a cold environment of 4°C
(D) Incubating in a microaerophilic environment at 42°C

NODIA

104. Read the given statements and select the correct option.
Statement I: Aflatoxin M1 is frequently found in the milk of cows fed with feed contaminated by Aflatoxin B1.
Statement II: Aflatoxin M1 is completely destroyed by standard commercial pasteurization of milk.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

105. Outbreak of gastroenteritis follows a large wedding reception. Epidemiologists note that the median incubation period is 12 hours, and symptoms predominantly feature abdominal cramps and diarrhea, but rarely fever or vomiting. The suspected vehicle is roast beef stored in large, deep pans. The most likely agent is:
(A) Staphylococcus aureus
(B) Clostridium perfringens
(C) Bacillus cereus (emetic strain)
(D) Salmonella Typhi

106. The intrinsic factor that most significantly determines the susceptibility of a food product to microbial spoilage and pathogenic growth is:
(A) Relative humidity of the storage environment
(B) Water activity (a_w)
(C) Storage temperature
(D) Ambient gaseous atmosphere

107. Match the disease in List I with its typical incubation period in List II.
List I: (Disease)
P. Staphylococcal food poisoning
Q. Campylobacteriosis
R. Hepatitis A
S. Listeriosis
List II: (Typical incubation period)
I. 2 to 5 days

metals inside the edible swine muscle tissue

92. Match the molecular method for AMR detection in List I with its description in List II.
List I: (Molecular method for AMR detection)
P. Whole Genome Sequencing (WGS)
Q. Multiplex PCR
R. Microarray
S. Plasmid profiling
List II: (Description)
I. Amplifies multiple specific resistance genes simultaneously in one reaction
II. Provides the complete DNA sequence, allowing identification of all known resistance genes
III. Analyzes the number and size of extrachromosomal DNA elements
IV. Uses a chip with thousands of DNA probes to detect specific resistance alleles via hybridization
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-III, R-II, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-II, Q-IV, R-I, S-III

93. The concept of "D-value" in thermal microbiology is defined as:
(A) The absolute thermal temperature required to completely destroy all active microorganisms in a food matrix
(B) The physical distance heat must penetrate to successfully reach the geometric cold spot of a metal can
(C) The specific absorption dose of ionizing radiation needed to completely sterilize a finished food product
(D) The time required at a specific temperature to reduce microbial count by 90%

94. Which of the following correctly describes the pathogenesis of enteropathogenic E. coli (EPEC)?
(A) Production of potent Shiga toxins directly leading to systemic acute renal failure
(B) Direct active invasion of the intestinal mucosa causing severe inflammatory bloody diarrhea
(C) Formation of attaching and effacing (A/E) lesions on host cells
(D) Secretion of heat-stable enterotoxins leading to acute watery osmotic diarrhea

95. Consider the following statements regarding the control of Listeria monocytogenes in food processing facilities:
I. It is notorious for forming persistent biofilms on stainless steel surfaces.
II. Environmental monitoring programs are essential to detect its harborage sites.
III. It can survive and grow in damp environments like floor drains and cooling units.
IV. Routine pasteurization is ineffective against its vegetative cells.
(A) II, III, and IV
(B) I, II, and III
(C) I, III, and IV
(D) I, II, and IV

96. Which of the following is an incorrect statement about Clostridium botulinum neurotoxins?
(A) They are synthesized as single-chain polypeptides that are later cleaved into active di-chains
(B) Type A is the most potent and commonly associated with human botulism in the US
(C) The toxin causes a descending flaccid paralysis
(D) The toxins are highly heat-resistant and require boiling for hours to be destroyed

97. Which of the following correctly pairs the pathogen with its oxygen requirement?
(A) Salmonella Typhimurium - Facultative anaerobe
(B) Campylobacter jejuni - Strict obligate aerobe
(C) Clostridium perfringens - Strict obligate aerobe
(D) Listeria monocytogenes - Obligate anaerobe

98. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The widespread use of third-generation cephalosporins in poultry has been linked to the rise of ESBL-producing Salmonella in humans.
Reason (R): Plasmids carrying ESBL genes can easily transfer from commensal bacteria in poultry to pathogenic Salmonella via horizontal gene transfer.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.

Downloaded from www.pdf.tube

protocols from large pharmaceutical manufacturing plants
(C) The widespread prophylactic use of key chemical antimicrobials in industrial aquaculture
(D) The rapid global trade of live food-producing animals and finished food products

116. What is the fundamental mechanism responsible for the toxicity of domoic acid?
(A) It binds strongly to voltage-gated sodium channels, completely preventing nerve impulse transmission
(B) It causes specific enzymatic lysis of red blood cells leading directly to severe clinical anemia
(C) It irreversibly inhibits acetylcholinesterase, leading to continuous, uncontrolled muscle contraction
(D) It mimics glutamate, overstimulating specific brain receptors and causing damage

117. Which is the most appropriate mitigation strategy for preventing histamine (scombroid) poisoning in fisheries?
(A) Implementing rigorous, systematic organoleptic sensory testing on the fish prior to cooking
(B) Ensuring rapid chilling of fish after catch and maintaining the cold chain
(C) Cooking the raw fish to an elevated internal temperature of 80°C to destroy histamine
(D) Administering synthetic antihistamines directly to the live fish operations prior to harvest

118. When evaluating a Hazard Analysis and Critical Control Point (HACCP) plan for a cooked meat product, a Food Safety Officer must ensure which competency is applied to the cooking step?
(A) Ensuring the finished meat looks highly aesthetically pleasing and well-browned on the outside surfaces
(B) Confirming that all of the physical cooking equipment is exclusively made of high-grade stainless steel
(C) Validating that parameters are scientifically proven to achieve the target log reduction
(D) Checking and verifying that the incoming raw meat was visually free of any obvious bacterial colonies

119. Read the given statements and select the correct option.
Statement I: Clostridium perfringens enterotoxin is produced during the vegetative growth phase in food left at room temperature.
Statement II: Ingestion of high numbers of viable vegetative C. perfringens cells is typically required to cause illness.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

NODIA

120. An outbreak of severe bloody diarrhea occurs at a day-care center. The investigation reveals secondary person-to-person transmission among the children. Given the exceptionally low infectious dose (10-100 cells) and symptoms, the most likely bacterial agent is:
(A) Shigella sonnei
(B) Salmonella Enteritidis
(C) Vibrio cholerae
(D) Clostridium perfringens

121. The cause and effect of toxoplasmosis transmission via food primarily stems from:
(A) Consuming raw agricultural produce heavily contaminated by the fresh feces of infected dogs
(B) Consuming undercooked meat with tissue cysts, or food contaminated by cat feces
(C) Drinking unpasteurized raw milk harvested from chronically infected dairy cattle herds
(D) Eating raw ocean fish species that act as natural intermediate hosts for the parasite

122. Match the fungal species in List I with the primary mycotoxin it produces in List II.
List I: (Fungal species)
P. Aspergillus flavus
Q. Penicillium verrucosum
R. Fusarium verticillioides
S. Claviceps purpurea
List II: (Primary mycotoxin)
I. Ochratoxin A
II. Fumonisin
III. Ergot alkaloids
IV. Aflatoxin
(A) P-I, Q-IV, R-III, S-II
(B) P-IV, Q-I, R-II, S-III
(C) P-IV, Q-II, R-I, S-III
(D) P-III, Q-I, R-IV, S-II

(C) Ingestion of spores that germinate and produce toxin in the immature gut
(D) An acute allergic reaction to the cow's milk protein content in commercial formula milk

77. Match the antimicrobial resistance term in List I with its description in List II.
List I: (Antimicrobial resistance term)
P. Intrinsic resistance
Q. Acquired resistance
R. Cross-resistance
S. Multi-drug resistance (MDR)
List II: (Description)
I. Resistance to three or more classes of antimicrobial agents
II. Inherent structural or functional characteristics that allow tolerance to a particular drug
III. Gaining resistance traits via mutation or horizontal gene transfer
IV. A single resistance mechanism conferring resistance to an entire class of drugs
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-IV, R-III, S-I
(C) P-I, Q-III, R-IV, S-II
(D) P-II, Q-III, R-IV, S-I

78. Which of the following best describes the principle behind the Disc Diffusion (Kirby-Bauer) test for AMR detection?
(A) Measuring the optical density of a growing liquid culture containing various antibiotic concentrations
(B) Amplifying the specific chromosomal resistance gene sequence utilizing standard Taq DNA polymerase
(C) Measuring the zone of inhibition around an antibiotic-impregnated paper disc on agar
(D) Extracting and purifying the plasmid DNA elements directly from the lysed bacterial cell

79. The definition of a "reservoir" in the context of foodborne pathogens and AMR refers to:
(A) The specific geographical location and retail market venue where a finished food product is sold
(B) Any environment or host where an infectious agent normally lives and multiplies
(C) The final definitive biological host species in which a parasite reaches its full sexual maturity
(D) The sterile stainless steel storage and holding tanks used in modern industrial dairy processing

80. Consider the following statements about cross-contamination:
I. It only occurs through direct contact between raw and cooked foods.
II. Color-coded cutting boards are a widely accepted strategy to minimize it.
III. It is a major pathway for the spread of AMR pathogens in domestic kitchens.
IV. Airborne aerosols can serve as a vehicle for cross-contamination in processing plants.
(A) I, II, and III
(B) I, III, and IV
(C) I, II, and IV
(D) II, III, and IV

81. Which of the following is a correct statement about mycotoxin production?
(A) Aflatoxins are produced by Aspergillus flavus and Aspergillus parasiticus
(B) Fungi strictly require absolute anaerobic environmental conditions to synthesize mycotoxins
(C) Toxic mycotoxins are exclusively synthesized and accumulated during the pre-harvest stage of crops
(D) High moisture content in stored agricultural grains effectively inhibits active mycotoxin production

82. Which of the following is an incorrect statement regarding prevention strategies for foodborne illness?
(A) Pasteurization of commercial raw milk effectively eliminates the health risk of associated outbreaks
(B) The systematic use of approved chemical sanitizers is highly essential for cleaning food contact surfaces
(C) Freezing meat to -18°C destroys all bacterial vegetative cells
(D) Maintaining a strict continuous cold chain is absolutely critical to preventing the overgrowth of psychrotrophic pathogens

83. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The use of antimicrobials in agriculture can lead to the emergence of resistant strains of Salmonella.

Click Here to Buy book on Amazon

appropriate temperature
2. Measure the zones of inhibition and compare them to standardized CLSI/EUCAST breakpoints
3. Prepare a bacterial suspension matching a 0.5 McFarland standard
4. Apply antibiotic-impregnated discs to the agar surface
5. Swab the suspension evenly over a Mueller-Hinton agar plate

(A) 3, 5, 4, 1, 2
(B) 3, 4, 5, 1, 2
(C) 5, 3, 4, 1, 2
(D) 4, 3, 5, 1, 2

132. What is the most appropriate course of action if an FSO identifies the presence of Aflatoxin B1 in a raw milk sample?
(A) Ignore the finding, as Aflatoxin B1 exclusively affects dry grains and raw nuts
(B) Recommend increasing the pasteurization temperature by 5°C to denature the toxin
(C) Immediately and permanently slaughter the entire dairy herd on the farm
(D) Trace back the dairy herd's feed supply to test for contamination

133. A food scientist is designing a shelf-stable, low-acid beverage. To prevent botulism without using extreme heat, which competency must the scientist apply?
(A) Relying solely on a prolonged thermal holding time at a constant temperature of 60°C
(B) Using hurdle technology by combining mild heat, lower pH, and preservatives
(C) Ensuring the retail beverage is heavily carbonated to completely eliminate molecular oxygen
(D) Testing the final beverage product for generic E. coli as a surrogate indicator of safety

134. Read the given statements and select the correct option.
Statement I: Whole Genome Sequencing (WGS) is currently the gold standard for tracking foodborne outbreak clusters.
Statement II: WGS can determine the genetic relatedness of bacterial isolates with single-nucleotide precision.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

135. In a small rural town, several residents develop acute liver inflammation. Epidemiological investigation reveals they all consumed raw oysters from a specific local estuary. The most likely etiological agent is:
(A) Norovirus
(B) Vibrio vulnificus
(C) Salmonella Typhi
(D) Hepatitis A virus

136. The phenomenon of antimicrobial resistance spreading rapidly through a population of mixed bacterial species in a wastewater treatment plant is a direct effect of:
(A) Horizontal gene transfer facilitated by high cell density and plasmids
(B) Vertical gene transfer occurring during extremely rapid bacterial binary fission events
(C) The natural, spontaneous background mutation rate of the key bacterial chromosomes
(D) The gradual chemical degradation and breakdown of the antimicrobial agents by the water

137. Match the mechanism of antimicrobial resistance in List I with its classic example in List II.
List I: (Mechanism of antimicrobial resistance)
P. Target site modification
Q. Enzymatic inactivation
R. Active efflux
S. Decreased permeability
List II: (Classic example)
I. Beta-lactamase production destroying penicillins
II. Alteration of penicillin-binding proteins in MRSA
III. Loss of outer membrane porins in Gram-negative bacteria
IV. Pumping tetracycline out of the bacterial cell
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-I, R-IV, S-III
(C) P-II, Q-IV, R-I, S-III
(D) P-III, Q-I, R-IV, S-II

138. Which of the following defines the "Z-value" in thermal processing?
(A) The specific time required to achieve a 1-log (90%) reduction of a target pathogen

Downloaded from www.pdf.tube

ANSWERS

1. (A) The occurrence of two or more cases of similar illness from a common food
A foodborne disease outbreak is epidemiologically defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food. This definition helps public health authorities identify potential contamination sources, track transmission patterns, and implement timely control measures to protect the population from widespread infection.

2. (C) P-II, Q-III, R-I, S-IV
Foodborne illnesses are categorized by their pathological mechanisms and causative agents. Salmonella Enteritidis causes infections by colonizing intestinal tissues, while Staphylococcus aureus produces preformed toxins leading to intoxication. Clostridium perfringens causes toxin-mediated infections during sporulation in the gut, and Cryptosporidium parvum is a protozoan parasite that causes waterborne and foodborne parasitic infections.

3. (A) The illness is caused by ingesting preformed toxins present in the food
Foodborne intoxication occurs when a person ingests toxins that pathogens have already produced in the food before consumption. Unlike foodborne infections, which require the ingestion and subsequent colonization of viable pathogens in the gastrointestinal tract, intoxications result directly from the chemical action of the preformed toxins, often leading to rapid symptom onset.

4. (D) They require the ingestion of viable microorganisms that multiply in the host
Foodborne infections develop when viable pathogenic microorganisms are consumed through contaminated food or water. Once inside the host, these living pathogens must survive the gastric acid barrier, reach the intestines, and actively multiply or invade the mucosal lining. This colonization process explains why infections generally have longer incubation periods than toxin-mediated food poisonings.

5. (B) I, III, and IV
Foodborne infections require pathogen ingestion and multiplication, leading to longer incubation periods and common systemic symptoms like fever. Conversely, intoxications involve preformed toxins, which act rapidly and rarely induce fever. Toxin-mediated infections require live bacteria to colonize the intestine and produce toxins. Heat treatment does not always prevent intoxications because some bacterial toxins are highly heat-stable.

6. (C) Ingestion of the preformed toxin in the food is the primary cause of illness
Toxin-mediated infections differ from simple intoxications because they require the ingestion of live, viable pathogens rather than preformed toxins. Once inside the host's intestinal tract, these microorganisms colonize the mucosa and produce harmful toxins during their growth or sporulation phases. A high infectious dose is typically necessary to establish this type of foodborne illness.

7. (D) Campylobacter jejuni - Raw milk and poultry
Campylobacter jejuni is a major zoonotic pathogen primarily found in the gastrointestinal tracts of warm-blooded animals, particularly poultry. Consumption of undercooked chicken or cross-contaminated ready-to-eat foods is a major transmission route. Raw, unpasteurized milk also serves as a significant reservoir due to direct fecal contamination during the milking process on dairy farms.

8. (A) Both A and R are true and R is the correct explanation of A.
Salmonella Enteritidis poses a unique public health challenge because it can colonize the ovarian tissue of healthy laying hens. This colonization allows the bacteria to be vertically transmitted into the yolk or albumen before the shell is formed. Consequently, intact, clean-looking eggs can harbor the pathogen, making raw or undercooked egg consumption a major risk.

9. (B) Bacillus cereus - Cross-contamination from raw poultry
Bacillus cereus is an environmental, spore-forming bacterium widely distributed in soil, dust, and cereal crops, rather than being associated with poultry reservoirs. It typically causes foodborne

NODIA

production farms

146. A critical limit in a HACCP plan for a continuous poultry fryer requires a minimum internal temperature of 74°C ($165^{\circ}F$). The primary biological hazard targeted by this limit is:
(A) Heat-resistant Clostridium botulinum endospores
(B) Active enteric Hepatitis A virus
(C) Salmonella spp. and Campylobacter spp.
(D) Carcinogenic fungal aflatoxins

147. What is the most appropriate interpretation of a finding where environmental swabs in a dairy plant repeatedly test positive for Listeria spp., even though end-product testing is negative?
(A) A persistent environmental biofilm exists, posing a continuous risk of contamination
(B) The processing plant is perfectly safe because the final packaged product is not contaminated
(C) The analytical laboratory is likely experiencing false positives due to poor internal testing methodology
(D) The commercial cleaning chemicals are directly causing a rapid mutation in the target bacteria

148. Which competency is essential for a Food Safety Officer when reviewing a facility's outbreak response plan?
(A) The physical ability to legally prosecute the food facility managers directly on the spot
(B) The biological ability to personally conduct high-throughput whole-genome sequencing
(C) The financial ability to dictate consumer market retail prices during a product recall
(D) The ability to assess the speed and accuracy of traceability and recall protocols

149. Read the given statements and select the correct option.
Statement I: Mycotoxins are uniformly distributed throughout a batch of contaminated grain.
Statement II: Sampling protocols for mycotoxins must involve taking multiple incremental samples to form an aggregate sample due to their heterogeneous distribution.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

150. A major foodborne outbreak is traced back to a specific farm producing romaine lettuce. Investigations reveal the irrigation water was contaminated with feces from a nearby cattle feedlot. This scenario perfectly illustrates the cause and effect of:
(A) Standard AMR transmission via horizontal gene transfer in wastewater
(B) Direct post-processing contamination of finished foods by infected food handlers
(C) Pre-harvest contamination leading to a widespread foodborne outbreak
(D) Acute foodborne intoxication caused by toxic marine biotoxins

www.nodia.in

Click Here to Buy book on Amazon

(B) The temperature change required to alter the D-value tenfold
(C) The maximum thermal temperature an endospore can withstand before germinating
(D) The absolute amount of heat energy required to convert 1 gram of water to steam

139. Which of the following is a correct statement regarding the epidemiology of Listeria monocytogenes?
(A) It has a long incubation period up to 70 days, complicating investigations
(B) It predominantly causes severe clinical illness in healthy, non-compromised young adults
(C) The minimum infectious dose is universally established at exactly 10^6 CFU for all human populations
(D) It is transmitted primarily through inhaled airborne droplets inside modern food processing facilities

140. Consider the following statements regarding E. coli O157:H7:
I. It is incapable of fermenting sorbitol rapidly, which is used as a diagnostic marker.
II. It produces a toxin nearly identical to that produced by Shigella dysenteriae type 1.
III. Antibiotic therapy is the primary and highly recommended treatment for E. coli O157:H7 infections.
IV. Ruminants carry the pathogen asymptomatically in their gastrointestinal tract.
(A) I, II, and III
(B) II, III, and IV
(C) I, II, and IV
(D) I, III, and IV

141. Which of the following is an incorrect statement concerning the detection of Antimicrobial Resistance (AMR)?
(A) The MIC indicates whether an organism is susceptible, intermediate, or resistant based on established breakpoints
(B) Genotypic methods can detect silent resistance genes that are not phenotypically expressed
(C) Molecular methods like PCR offer faster turnaround times than traditional culture-based phenotypic testing
(D) Disc diffusion provides an exact quantitative measure of the antibiotic concentration needed to kill the bacteria

142. Which of the following correctly pairs the toxin with its heat stability?
(A) Staphylococcal enterotoxins - Highly heat labile
(B) Botulinum neurotoxins - Extremely heat stable
(C) Bacillus cereus emetic toxin (cereulide) - Heat stable
(D) Clostridium perfringens enterotoxins - Highly heat stable

143. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The use of unpasteurized milk for cheese making inherently carries a higher risk of transmitting zoonotic pathogens than using pasteurized milk.
Reason (R): Pasteurization is designed to eliminate all spore-forming bacteria from raw milk.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

144. Which of the following is an incorrect pair regarding the prevention of cross-contamination?
(A) Color-coded equipment - Separating raw and ready-to-eat workflows
(B) Positive air pressure in high-care zones - Preventing airborne contaminants from entering clean areas
(C) Footbaths and boot washers - Controlling pathogen entry from factory floors
(D) Using the same cutting board for raw chicken and salad - A safe practice if rinsed with cold water

NODIA

145. All of the following are characteristics of the One Health approach in combating AMR, except:
(A) Focusing surveillance on clinical human isolates while ignoring environments
(B) Promoting and enforcing the highly prudent use of all antimicrobials in veterinary medicine
(C) Developing national action plans that involve ministries of human health, agriculture, and environment
(D) Significantly improving hygiene standards and standard biosecurity measures on

illness through temperature abuse of starchy foods like rice, where spores survive cooking, germinate, and produce toxins. Poultry cross-contamination is instead the classic transmission route for Campylobacter and Salmonella species.

10. (B) Flaccid paralysis
Non-typhoidal Salmonellosis is characterized by acute gastrointestinal symptoms, including abdominal cramps, severe watery diarrhea, and high fever, resulting from localized mucosal inflammation and invasion. Flaccid paralysis is not a clinical feature of this infection; instead, it is a hallmark symptom of botulism, which is caused by the action of Clostridium botulinum neurotoxins at neuromuscular junctions.

11. (A) 2, 4, 1, 3, 5
Salmonella pathogenesis begins with the ingestion of contaminated food, followed by survival through the harsh acidic environment of the stomach. The bacteria then invade the intestinal mucosal cells and multiply within host macrophages to evade the immune system. This cellular invasion and multiplication trigger a robust inflammatory response, ultimately leading to acute diarrhea and abdominal cramps.

12. (C) Utilizing hyper-chlorinated water in the immersion chilling tanks
During poultry processing, the immersion chilling step represents a critical control point where cross-contamination can easily occur among carcasses. Utilizing hyper-chlorinated water in these chilling tanks effectively reduces the microbial load, specifically targeting pathogens like Campylobacter jejuni on the carcass surfaces. This chemical intervention is a key hurdle in preventing widespread pathogen transmission during large-scale processing.

13. (D) The farm's pasteurization and sanitation practices
To minimize the risk of Campylobacter jejuni transmission through raw milk, dairy operations must focus strictly on sanitation and pasteurization. Campylobacter is shedding from the gastrointestinal tracts of cows and can contaminate milk during extraction. Pasteurization is the most reliable control measure to eliminate vegetative pathogens, making the verification of thermal processing parameters a primary regulatory competency.

14. (D) Statement I is false but Statement II is true
Campylobacter species are sensitive to environmental stresses and do not survive well during drying, freezing, or exposure to atmospheric oxygen. However, Campylobacter jejuni is microaerophilic, meaning it requires low oxygen concentrations, typically between three and fifteen percent, and elevated carbon dioxide levels for optimal growth, making specialized incubation atmospheres necessary for its laboratory isolation.

15. (B) Escherichia coli O157:H7
Escherichia coli O157:H7 is a well-known enterohemorrhagic pathogen associated with undercooked ground beef, as grinding distributes surface contamination throughout the meat. This bacterium produces Shiga toxins that damage vascular endothelial cells, particularly in the kidneys. This pathogenesis leads to clinical manifestations such as bloody diarrhea and the life-threatening condition known as hemolytic uremic syndrome.

16. (D) Its extreme acid tolerance response allowing survival at low pH
Escherichia coli O157:H7 possesses an exceptionally robust acid tolerance response, which is regulated by specific genetic mechanisms. This physiological adaptation allows the vegetative cells to survive passage through the highly acidic human stomach and persist in low-pH food matrices, such as fermented sausages, apple cider, and yogurt, posing a significant risk even at low infectious doses.

17. (A) P-IV, Q-I, R-II, S-III
Pathogenic Escherichia coli strains are classified by their distinct virulence factors and clinical mechanisms. Enterotoxigenic strains produce heat-labile and heat-stable toxins associated with traveler's diarrhea. Enteropathogenic strains form attaching and effacing lesions on microvilli. Enterohemorrhagic strains produce Shiga-like toxins, causing severe hemorrhagic colitis and hemolytic uremic syndrome, while enteroinvasive strains invade colon cells, causing dysentery-like symptoms.

18. (C) An increase in branched-chain fatty acids within its cell membrane
Listeria monocytogenes adaptively regulates its cell membrane fluidity to survive and grow at refrigeration temperatures. When exposed to cold, the bacterium increases the proportion of

Downloaded from www.pdf.tube

through direct contact, water runoff, and contaminated food products.

54. (C) Polymerase Chain Reaction (PCR) - Phenotypically assesses the survival of bacteria in varying antibiotic broth dilutions
Polymerase chain reaction is a genotypic method used to detect the physical presence of specific antimicrobial resistance genes within bacterial DNA. It does not assess phenotypic survival, which is instead measured using culture-based assays like broth microdilution or disc diffusion. PCR provides rapid genetic identification but cannot confirm whether the resistance genes are actively expressed by the pathogen.

55. (D) Evaporation of water into the atmosphere forming sterile rain
Water systems act as major transmission pathways for antimicrobial-resistant bacteria and resistance genes. Contamination occurs through the discharge of untreated hospital wastewater, agricultural runoff containing animal manure, and aquaculture effluents. In contrast, the evaporation of water into the atmosphere is a natural physical process that separates water from contaminants, forming sterile rain that does not transmit resistance.

56. (A) The isolate is resistant, meaning standard doses of ciprofloxacin may fail
A high minimum inhibitory concentration for ciprofloxacin indicates that the Salmonella isolate requires elevated levels of the drug to inhibit its growth. This phenotypic result classifies the bacterium as resistant according to established clinical breakpoints. Consequently, standard therapeutic doses of ciprofloxacin are likely to fail, requiring clinicians to select alternative, effective antimicrobial agents for treatment.

57. (B) Using standardized protocols and CLSI/ EUCAST guidelines for susceptibility testing
To establish a valid antimicrobial resistance surveillance plan for retail meats, officers must use standardized testing methodologies. Adhering to recognized international guidelines, such as those from CLSI or EUCAST, ensures that susceptibility data are highly accurate, reproducible, and comparable across different laboratories and regions. This consistency is essential for tracking resistance trends and informing public health policies.

58. (A) Both Statement I and Statement II are true
Cross-contamination in domestic and commercial kitchens easily transfers antimicrobial-resistant pathogens from raw agricultural products to ready-to-eat foods like salads, bypassing subsequent thermal steps. However, standard cooking temperatures remain highly effective at destroying these resistant bacteria, because antimicrobial resistance mechanisms protect against therapeutic chemical drugs rather than physical heat denaturation of cellular proteins.

59. (A) PulseNet
PulseNet is a highly coordinated national surveillance network that uses molecular subtyping, such as pulsed-field gel electrophoresis and whole-genome sequencing, to identify foodborne illness clusters. By matching genetic fingerprints of bacterial isolates from different states, PulseNet enables epidemiologists to detect widespread, low-level outbreaks linked to a common source, such as a single contaminated food processing facility.

60. (C) Administering beneficial gut microflora to chicks to prevent Salmonella colonization
Competitive exclusion is a preventative strategy used in poultry production to control zoonotic pathogens like Salmonella. It involves administering a mixture of beneficial gut microbiota to newly hatched chicks. These probiotic bacteria rapidly colonize the immature intestinal tract, physically blocking adhesion sites and competing for essential nutrients, thereby preventing pathogenic colonization and reducing shedding.

61. (D) 2, 4, 1, 3
Preventing foodborne illness requires a structured hierarchy of control strategies. The foundation begins with basic personal hygiene and handwashing. Building upon this, facilities establish standard sanitation operating procedures to maintain clean surfaces. Next, specific critical control points are managed using hazard analysis and critical control point plans, followed by end-product pathogen testing to verify the system's efficacy.

62. (C) P-II, Q-III, R-IV, S-I
Control strategies in food processing target specific pathogens and their survival characteristics. Maintaining food pH below 4.6 prevents the germination of Clostridium botulinum spores. Cooking pork thoroughly eliminates Trichinella

NODIA

27. (A) C. botulinum spores can germinate in highly oxygenated surface environments
Clostridium species are obligate anaerobes, meaning they generally require oxygen-free environments to grow and sporulate. While vegetative cells of some species like Clostridium perfringens show aerotolerance, the spores of Clostridium botulinum strictly require anaerobic conditions to germinate. They cannot germinate or produce toxins in highly oxygenated surface environments, which limit their growth to sealed or oxygen-depleted areas.

28. (C) Reducing Clostridium botulinum spore survival probability to 1 in 10^{12} cans
The 12D process, or botulinum cook, is the fundamental thermal sterilization standard for low-acid canned foods. It is designed to achieve a twelve-decimal reduction in the population of highly heat-resistant Clostridium botulinum spores. This standard ensures that the probability of spore survival is reduced to one in one trillion cans, guaranteeing commercial sterility and consumer safety.

29. (D) Clostridium perfringens
Clostridium perfringens is a spore-forming, anaerobic bacterium that multiplies rapidly in temperature-abused cooked foods, such as gravies, stews, and large meat joints. When these foods are cooled too slowly or held at room temperature, surviving spores germinate and multiply. Consuming these contaminated foods leads to toxin production in the host's intestine, causing acute diarrhea and abdominal cramps.

30. (D) Statement I is false but Statement II is true
Clostridium perfringens food poisoning is a toxin-mediated infection rather than an intoxication caused by preformed toxins. The illness occurs when a person ingests a large number of viable vegetative cells. Once these cells reach the small intestine, they undergo sporulation. The enterotoxin is synthesized and released into the intestinal lumen specifically during the lysis of the mother cell.

31. (B) 4, 2, 1, 3, 5
The pathogenesis of Clostridium perfringens begins when temperature abuse of cooked meat allows spores to germinate and multiply. Upon ingestion, a large number of vegetative cells survive the stomach acid and enter the small intestine. There, the bacteria undergo sporulation, releasing enterotoxins during mother cell lysis. The toxin then binds to intestinal epithelial cells, causing severe fluid loss.

32. (D) P-IV, Q-II, R-III, S-I
Bacillus cereus causes two distinct food poisoning syndromes. The emetic syndrome is caused by cereulide, a highly heat-stable toxin preformed in starchy foods like fried rice. The diarrheal syndrome is caused by heat-labile enterotoxins produced in the small intestine after consuming contaminated proteinaceous foods or vegetables, which contain viable vegetative cells or spores of the bacterium.

33. (A) Cooling cooked rice to below 5°C and storing it refrigerated
The emetic syndrome of Bacillus cereus is caused by the preformed toxin cereulide, which is highly heat-stable and resists subsequent cooking. To prevent toxin formation, kitchens must prevent the germination of spores and subsequent vegetative growth in cooked rice. Rapidly cooling cooked rice to below five degrees Celsius and maintaining refrigeration effectively inhibits bacterial proliferation and toxin production.

34. (C) Spore germination and subsequent production of a heat-stable toxin
Leaving boiled rice at room temperature overnight allows surviving endospores of Bacillus cereus to germinate and multiply rapidly. During this vegetative growth, the bacteria produce the heat-stable toxin cereulide. Because this toxin resists reheating, consumers who eat the rice experience rapid-onset nausea and vomiting. This scenario demonstrates how temperature abuse leads to intoxication via highly stable microbial toxins.

35. (A) II, III, and IV
Vibrio cholerae is the causative agent of epidemic cholera, with serogroups O1 and O139 primarily responsible for large-scale outbreaks. It produces a potent A-B type enterotoxin that stimulates adenylate cyclase, leading to massive, watery diarrhea. Although it is a marine bacterium, it is not strictly halophilic and can survive in freshwater environments, particularly when contaminated with human feces.

Click Here to Buy book on Amazon

36. (D) It is highly resistant to freezing, meaning frozen storage of seafood increases its viable counts

Vibrio parahaemolyticus is a leading cause of seafood-associated gastroenteritis, primarily linked to raw or undercooked shellfish. Its pathogenicity is closely correlated with the production of thermostable direct hemolysin. Although cooking easily destroys the bacterium, it is highly sensitive to cold temperatures. Freezing and cold storage significantly reduce its viable counts over time, making frozen storage an effective control measure.

37. (B) Norovirus - Fecal-oral route, primarily via infected food handlers

Norovirus is a highly contagious agent responsible for the majority of non-bacterial gastroenteritis outbreaks worldwide. It is transmitted primarily via the fecal-oral route, often when infected food handlers touch ready-to-eat foods without proper hand hygiene. Its low infectious dose and high persistence on environmental surfaces facilitate rapid spread within restaurants, schools, cruise ships, and healthcare facilities.

38. (D) A is false but R is true.

Using bacterial indicators like Escherichia coli does not provide a reliable measure of viral contamination such as Norovirus. Viruses differ from bacteria in their structure, survival mechanisms, and persistence in the environment, often resisting standard sanitizers and wastewater treatments far better than indicator bacteria. Therefore, testing for E. coli cannot predict the presence or absence of viral pathogens.

39. (D) Typically 2 to 4 days

Hepatitis A virus is a non-enveloped, single-stranded RNA virus that is highly resistant to low pH and freezing temperatures. It infects hepatocytes, leading to liver inflammation and clinical symptoms like jaundice. However, it has a characteristically long incubation period, typically ranging from fifteen to fifty days, which is much longer than the rapid incubation periods of common bacterial pathogens.

40. (A) They are highly susceptible to standard municipal water chlorination

Cryptosporidium parvum and Giardia lamblia are protozoan parasites that pose severe waterborne public health risks. They produce thick-walled oocysts and cysts that are extremely resistant to environmental stressors, including standard chlorine concentrations used in municipal water disinfection. Consequently, water treatment facilities must rely on physical filtration methods or ultraviolet irradiation to effectively remove or inactivate these infectious parasites.

41. (B) 1, 2, 4, 5, 3

The waterborne transmission cycle of Giardia lamblia begins with the ingestion of infectious cysts from contaminated water. Once inside the host, exposure to stomach acid triggers excystation in the small intestine, releasing active trophozoites. These trophozoites multiply via binary fission, colonizing the mucosa. As they transit toward the colon, dehydration induces encystation, and infectious cysts are excreted in feces.

NODIA

42. (B) Establishing maximum allowable limits and conducting batch testing

Aflatoxins are highly carcinogenic mycotoxins produced by Aspergillus species on crops like peanuts. Because they are chemically stable and resist heat, thermal processing cannot eliminate them from finished foods. The most effective regulatory approach involves establishing strict maximum residue limits and performing systematic batch testing of raw materials, ensuring that contaminated crops are excluded from the supply chain.

43. (A) Identifying improper storage conditions that allow fungal growth

Ochratoxin A is a toxic mycotoxin produced by Penicillium and Aspergillus species during the storage of agricultural commodities like coffee beans, cocoa, and grains. Elevated levels of this toxin indicate that the raw materials were kept under improper, humid conditions that allowed mold proliferation. Analysts must investigate storage moisture levels and ventilation to locate the source of fungal contamination.

44. (A) Both Statement I and Statement II are true

Fumonisin mycotoxins are secondary metabolites produced primarily by Fusarium species, which commonly infect cereal crops. Fumonisin B1 is the most prevalent and toxic member of this group, frequently contaminating corn and corn-based products. Chronic dietary exposure to these toxins has been epidemiologically linked to high rates of esophageal cancer and neural tube defects in human populations.

45. (D) Paralytic shellfish poisoning (PSP)
Paralytic shellfish poisoning is a severe marine biotoxication caused by the ingestion of bivalve mollusks that have accumulated saxitoxins. These toxins are produced by dinoflagellates during harmful algal blooms, known as red tides. Clinical symptoms appear rapidly and are characterized by neurological signs, including tingling and numbness of the lips and tongue, followed by muscular paralysis and respiratory distress.

46. (C) Filter-feeding of mollusks on toxic dinoflagellates like Alexandrium spp.
Saxitoxin accumulation in bivalve mollusks is a biological consequence of their filter-feeding behavior. During harmful algal blooms, mollusks consume large quantities of toxic dinoflagellates, such as Alexandrium species. The mollusks concentrate the heat-stable saxitoxins in their tissues without being harmed themselves. When humans ingest these contaminated shellfish, the toxins block sodium channels, causing severe neurological symptoms and paralysis.

47. (B) P-IV, Q-I, R-II, S-III
Marine biotoxins are categorized by their chemical origins and clinical syndromes. Ciguatoxins originate from benthic dinoflagellates and bioaccumulate in predatory reef fish like barracuda. Domoic acid causes amnesic shellfish poisoning, characterized by memory loss. Okadaic acid is the primary cause of diarrhetic shellfish poisoning, inducing severe gastrointestinal distress, while brevetoxin causes neurotoxic shellfish poisoning through sodium channel activation in shellfish consumers.

48. (D) The acquired ability of a microbe to resist the effects of an antimicrobial agent
Antimicrobial resistance is defined as the acquired ability of a microorganism, such as a bacterium, virus, or parasite, to resist the inhibitory or lethal effects of an antimicrobial drug to which it was previously susceptible. This genetic adaptation allows pathogens to survive therapeutic concentrations of antibiotics, complicating clinical treatments and increasing the risk of persistent foodborne infections.

49. (A) Acceleration of host immune responses to clear the antibiotic
Bacteria utilize specific biochemical mechanisms to resist antibiotics, including efflux pumps to actively export drugs, enzymes to degrade or modify the antibiotic compound, and genetic mutations that alter target binding sites. Accelerating host immune responses is not a bacterial mechanism of resistance; rather, resistance mechanisms function directly within the bacterial cell to neutralize or evade the therapeutic chemical agent.

NODIA

50. (C) I, III, and IV
Antimicrobial resistance genes are frequently located on mobile genetic elements, such as plasmids, allowing horizontal transfer between different bacterial species via conjugation, transformation, or transduction. The use of sub-therapeutic antibiotics in livestock feed creates selective pressure that accelerates this resistance. Crucially, commensal bacteria in the animal gut act as a major reservoir for these resistance genes.

51. (A) ESBL-producing bacteria are completely susceptible to cephalosporins
Extended-spectrum beta-lactamases are bacterial enzymes that hydrolyze the beta-lactam ring of penicillin and cephalosporin antibiotics, rendering them inactive. Consequently, ESBL-producing bacteria are highly resistant to these broad-spectrum drugs, posing severe clinical treatment challenges. These resistant strains, commonly found in Enterobacteriaceae like Escherichia coli and Salmonella, are increasingly isolated from food-producing animals and agricultural products.

52. (D) Vancomycin-Resistant Enterococci (VRE) - Intensive poultry and swine farming
Vancomycin-resistant enterococci have been closely linked to intensive poultry and swine farming operations. This association arose from the historical use of avoparcin, a glycopeptide antibiotic growth promoter, which created selective pressure favoring resistant strains. Although avoparcin use has been banned in many regions, VRE remains a persistent zoonotic hazard in agricultural environments, capable of entering the human food chain.

53. (D) Both A and R are false.
The One Health approach emphasizes that human, animal, and environmental health are deeply interconnected, rather than separate domains. Antimicrobial resistance genes do not evolve exclusively in clinical settings; they actively emerge and circulate within agricultural environments due to veterinary antibiotic use, subsequently transferring to human pathogens

short, branched-chain, and unsaturated fatty acids within its lipid bilayer. This biochemical modification lowers the phase transition temperature, preventing membrane gelation and maintaining essential nutrient transport and enzymatic functions.

19. (A) A severe systemic infection affecting mainly high-risk patient populations
Listeriosis is defined as a severe systemic foodborne infection caused by Listeria monocytogenes, primarily targeting vulnerable populations, including pregnant women, newborns, elderly individuals, and immunocompromised patients. The pathogen can cross the intestinal, blood-brain, and placental barriers, leading to life-threatening clinical manifestations such as septicemia, meningitis, encephalitis, and spontaneous abortion or stillbirth in pregnant women.

20. (D) I, II, and IV
Listeria monocytogenes is a gram-positive, non-spore-forming rod that displays characteristic tumbling motility at room temperature due to flagella expression, which is downregulated at body temperature. It is an intracellular pathogen that utilizes actin-based motility to spread directly between host cells. Crucially, Listeria is highly halotolerant and can easily survive in environments with high salt concentrations.

21. (B) The enterotoxins are highly heat-resistant and survive normal cooking
Staphylococcus aureus produces several enterotoxins during vegetative growth in temperature-abused foods. These enterotoxins are exceptionally heat-stable, resisting normal boiling temperatures and even pasteurization. Consequently, while cooking easily destroys the vegetative bacterial cells, the active toxin remains in the food matrix, leading to rapid-onset food poisoning characterized by severe vomiting and abdominal cramps upon ingestion.

22. (C) High osmotic pressure (e.g., in cured meats) effectively inhibits the growth of S. aureus
Staphylococcus aureus is uniquely osmotolerant among foodborne pathogens, capable of growing at a water activity as low as 0.85, which corresponds to high salt concentrations. Therefore, high osmotic pressure, such as that found in cured meats, does not inhibit its growth. Instead, it reduces competing background microbiota, allowing the pathogen to proliferate and produce enterotoxins.

23. (D) A is false but R is true.
Reheating food to seventy-four degrees Celsius destroys the vegetative cells of Staphylococcus aureus, but it does not guarantee safety if the food has already been contaminated and temperature-abused. This limitation exists because the preformed enterotoxins are highly heat-stable and can withstand boiling, meaning the food remains toxic even after the bacteria themselves have been killed.

24. (A) Blocking the release of acetylcholine at the neuromuscular junction
The neurotoxin produced by Clostridium botulinum is one of the most potent biological toxins known. Its primary mechanism of action involves binding to presynaptic membranes at neuromuscular junctions, where it cleaves SNARE proteins. This enzymatic cleavage prevents the exocytosis of the neurotransmitter acetylcholine, blocking nerve signals to muscles and resulting in flaccid paralysis and respiratory failure.

25. (B) Processing low-acid foods in a boiling water bath instead of a pressure canner
Clostridium botulinum spores are highly heat-resistant and can survive boiling water temperatures. In low-acid foods like green beans, surviving spores can germinate, multiply, and produce neurotoxins in the anaerobic environment of sealed jars. To prevent this, a pressure canner must be used to achieve temperatures above one hundred twenty-one degrees Celsius, which successfully destroys the spores.

26. (B) Type A - Proteolytic strains in home-canned vegetables
Clostridium botulinum strains are grouped by toxin type and physiological characteristics. Type A consists of highly proteolytic strains that produce extremely potent toxins, commonly associated with soil contamination and home-canned vegetables. Type E strains are non-proteolytic, psychrotrophic, and primarily found in marine environments, making them major hazards in improperly processed fish and other seafood products.

Downloaded from www.pdf.tube

spiralis larvae. Rapidly chilling meat prevents Clostridium perfringens vegetative growth, while avoiding raw oysters is the primary mitigation strategy against Vibrio vulnificus infections in high-risk consumers.

63. (B) An approach recognizing the interconnection between people, animals, plants, and their environment
The One Health approach is a collaborative, multisectoral, and transdisciplinary framework that operates at local, national, and global levels. It recognizes that the health of humans is intimately connected to the health of animals, plants, and their shared environment. This holistic perspective is essential for effectively addressing complex, systemic public health issues like zoonotic diseases and antimicrobial resistance.

64. (D) They are toxic fungal metabolites produced under specific conditions
Mycotoxins are toxic secondary metabolites produced by certain filamentous fungi, such as Aspergillus, Penicillium, and Fusarium, under favorable temperature and moisture conditions. These chemical compounds are highly stable and resist standard cooking, baking, and pasteurization temperatures. Unlike bacterial toxins that cause acute symptoms, mycotoxins often lead to chronic health issues, including carcinogenicity, immunosuppression, and organ damage.

65. (A) I, II, and IV
Ciguatera fish poisoning is caused by consuming large predatory reef fish that have bioaccumulated ciguatoxins through the marine food chain. These toxins originate from benthic dinoflagellates like Gambierdiscus toxicus. A hallmark clinical symptom is temperature sensory reversal. Crucially, ciguatoxins are highly heat-stable and cold-resistant, meaning they cannot be deactivated by freezing or cooking the fish.

66. (C) It has a lipid envelope, making it highly susceptible to alcohol sanitizers
Norovirus is a non-enveloped virus, which makes it structurally highly resistant to physical and chemical stressors. Unlike enveloped viruses, it lacks a lipid bilayer, rendering standard alcohol-based hand sanitizers ineffective for inactivation. Instead, physical handwashing with soap and water or the use of chlorine-based disinfectants is required to destroy the viral capsid and prevent transmission.

67. (A) Fumonisin B1 - Neural tube/Esophagus
Mycotoxins exhibit specific organ toxicity in humans and animals. Fumonisin B1 is associated with neural tube defects and esophageal cancer. Aflatoxin B1 is a potent hepatotoxin and carcinogen targeting the liver. Ochratoxin A primarily causes nephrotoxicity, damaging renal kidney organs, while zearalenone possesses estrogenic activity, directly disrupting reproductive tract functions and causing fertility issues.

68. (A) Both A and R are true and R is the correct explanation of A.
Generic Escherichia coli is used as a sanitary indicator in water testing because it resides naturally in the intestinal tracts of warm-blooded animals and is excreted in large numbers. Since it typically does not survive for extended periods in environmental waters, its detection serves as a reliable, direct indicator of recent fecal contamination and potential pathogen presence.

NODIA

69. (B) Clostridium botulinum - Growth at pH of 4.2
Clostridium botulinum is a spore-forming anaerobe that is highly sensitive to acidic environments. The regulatory standard for low-acid canned foods is based on the biological fact that this bacterium cannot grow or produce neurotoxins at a pH below 4.6. Therefore, food products with a pH of 4.2 are naturally protected against botulinum growth and toxin production.

70. (C) The internal tissues of an intact, healthy apple
Salmonella contamination in agricultural environments typically occurs through external sources, such as raw manure application, bird droppings in irrigation water, or contaminated farm vehicles. Intact, healthy apples possess thick protective skins and an acidic internal environment that prevents bacterial entry and colonization, making their internal tissues an unlikely source of contamination compared to exposed surfaces.

71. (D) 3, 5, 1, 4, 2
A standard epidemiological foodborne outbreak investigation follows a structured sequence of phases. Investigators first verify the diagnosis and confirm the outbreak. They then define and identify active cases to determine the outbreak's scope. Next, they formulate hypotheses regarding the source, conduct analytical epidemiological studies to test these hypotheses, and implement targeted control and prevention measures.

72. (A) Initiate a voluntary product recall and halt distribution
When a food processing facility is notified that its product is epidemiologically or microbiologically linked to an outbreak of Escherichia coli O157:H7, the immediate priority is protecting public health. The most appropriate initial step is to halt product distribution and initiate a voluntary recall, removing contaminated food from retail channels while investigations continue.

73. (B) Conducting environmental swabbing for Listeria before and after sanitation
To validate a new sanitation protocol targeting Listeria monocytogenes in floor drains, facilities must collect objective microbiological data. This is achieved by conducting environmental swabbing both before and after the cleaning process. Analyzing these swabs for Listeria presence or indicator organisms provides direct evidence of the protocol's efficacy in removing biofilms and preventing pathogen persistence.

74. (C) Statement I is true but Statement II is false
Marine biotoxins like saxitoxins are highly heat-stable chemical compounds that are not destroyed by boiling, steaming, or cooking. Although harmful algal blooms, or red tides, are associated with these toxins, they are highly unpredictable and influenced by complex environmental factors. Therefore, continuous monitoring of shellfish tissues is required to ensure safety, rather than assuming predictable harvesting patterns.

75. (A) Vibrio cholerae
Vibrio cholerae is a gram-negative, curved rod that exhibits rapid, characteristic shooting-star motility under microscopic observation. It is transmitted through contaminated water and raw seafood, causing severe, secretory watery diarrhea. The cholera toxin stimulates active electrolyte and water secretion into the intestinal lumen, leading to rapid, life-threatening dehydration within hours if left untreated.

76. (C) Ingestion of spores that germinate and produce toxin in the immature gut
Infant botulism occurs when infants ingest Clostridium botulinum spores, commonly found in honey or soil. Because infants lack a fully developed intestinal microbiota, the ingested spores can easily germinate and colonize the large intestine. Once established, the vegetative cells produce neurotoxins in situ, leading to progressive flaccid paralysis, often characterized as floppy baby syndrome.

77. (D) P-II, Q-III, R-IV, S-I
Antimicrobial resistance terminology describes different mechanisms and scopes of resistance. Intrinsic resistance refers to inherent structural properties of a bacterium. Acquired resistance occurs when bacteria gain resistance traits via mutation or horizontal transfer. Cross-resistance occurs when a single mechanism confers resistance to an entire antibiotic class, while multidrug resistance indicates resistance to three or more antibiotic classes.

78. (C) Measuring the zone of inhibition around an antibiotic-impregnated paper disc on agar
The disc diffusion, or Kirby-Bauer, test is a standardized phenotypic assay used to evaluate antimicrobial susceptibility. An agar plate is swabbed with a bacterial suspension, and antibiotic-impregnated paper discs are placed on the surface. As the antibiotic diffuses, it inhibits bacterial growth. Measuring the resulting clear zone of inhibition allows technicians to classify the pathogen as susceptible or resistant.

79. (B) Any environment or host where an infectious agent normally lives and multiplies
In epidemiology, a reservoir is defined as any person, animal, plant, soil, substance, or environment in which an infectious agent normally lives, multiplies, and survives. The pathogen relies on the reservoir for its survival, from which it can be transmitted to a susceptible host, making reservoir identification crucial for designing effective control and prevention strategies.

80. (D) II, III, and IV
Cross-contamination is a major pathway for spreading pathogens, including antimicrobial-resistant strains, in both domestic and commercial environments. While color-coded cutting boards help mitigate this risk by separating raw and cooked foods, cross-contamination is not limited to direct contact. It can also occur through contaminated utensils, hands, and airborne aerosols within food processing plants.

81. (A) Aflatoxins are produced by Aspergillus flavus and Aspergillus parasiticus
Aflatoxins are highly toxic and carcinogenic mycotoxins produced primarily by the mold species Aspergillus flavus and Aspergillus

Click Here to Buy book on Amazon

parasiticus. These fungi require aerobic conditions and specific temperature ranges to grow and synthesize toxins. High moisture content in stored agricultural grains promotes active mold growth and mycotoxin production, making moisture control a key preventative strategy in post-harvest storage.

82. (C) Freezing meat to -18°C destroys all bacterial vegetative cells
Although freezing meat to minus eighteen degrees Celsius stops microbial growth, it does not destroy all vegetative bacterial cells. Many pathogens, such as Salmonella and Listeria, can survive frozen storage for extended periods in a dormant state. Upon thawing, these bacteria can resume active multiplication, emphasizing that freezing is a preservation method rather than a sterilization technique.

83. (A) Both A and R are true and R is the correct explanation of A.
The widespread use of sub-lethal concentrations of antimicrobials in animal agriculture creates a strong selective pressure within the livestock microbiome. This environment allows bacteria possessing resistance genes, such as resistant strains of Salmonella, to survive and proliferate while susceptible bacteria are eliminated. Consequently, these resistant pathogens can easily enter the human food supply chain.

84. (D) Gamma irradiation - DNA damage and strand breakage
Gamma irradiation is a physical food preservation technique that utilizes ionizing radiation to destroy microorganisms. The primary lethal mechanism involves direct damage to the microbial DNA, causing single- and double-strand breaks that prevent cell replication. Additionally, irradiation generates free radicals from water molecules within the cells, which further damage essential cellular proteins and membrane lipids.

85. (B) Mandating the exclusive use of traditional herbal remedies in livestock
National antimicrobial resistance surveillance systems rely on coordinated, science-based monitoring programs. These include tracking antimicrobial use in humans and livestock, monitoring resistance profiles of indicator bacteria from food-producing animals, and collecting clinical data on resistant infections. Mandating the exclusive use of traditional herbal remedies is not a component of these surveillance frameworks, which focus on objective data collection.

86. (C) They act as superantigens that stimulate vagus nerve endings in the stomach
Staphylococcus aureus enterotoxins cause severe, rapid-onset emesis through a specific neurotoxic mechanism. These toxins act as superantigens, binding directly to major histocompatibility complex class II molecules and triggering massive cytokine release. This immune activation stimulates the vagus nerve and preganglionic sympathetic nerves in the abdominal viscera, sending signals to the brain's emetic center to induce vomiting.

87. (D) Elevated concentrations of histamine
Scombroid fish poisoning, or histamine poisoning, occurs when dark-fleshed fish like tuna are subjected to time-temperature abuse after catch. Under warm conditions, histidine-decarboxylase-producing bacteria multiply and convert the amino acid histidine into histamine. Because histamine is heat-stable and cannot be destroyed by cooking, measuring elevated histamine levels is the primary indicator of temperature abuse in fisheries.

88. (A) Assessing pH decline relative to temperature during fermentation
Staphylococcus aureus can grow and produce enterotoxins in fermented sausages if the fermentation process is too slow. To evaluate this risk, food safety officers must assess the rate of pH decline relative to temperature. A rapid pH drop, driven by lactic acid bacteria, inhibits S. aureus before it can reach population densities sufficient for enterotoxin production.

89. (A) Both Statement I and Statement II are true
Hepatitis A virus is frequently transmitted through the consumption of raw or undercooked bivalve mollusks harvested from waters contaminated with human sewage. This transmission route exists because oysters, clams, and mussels are filter feeders that process large volumes of water, concentratedly retaining viral particles within their digestive tissues, which remain infectious to human consumers.

90. (B) Escherichia coli O157:H7
Applying raw, uncomposted manure to agricultural fields introduces enteric pathogens directly into the crop environment. Because ruminants like

NODIA

109. (D) Resistance to one agent confers resistance to others in the same class
Cross-resistance occurs when a single biochemical mechanism, such as an efflux pump or an altered target binding site, confers bacterial resistance to multiple different antimicrobial agents. This typically happens among drugs belonging to the same chemical class or sharing similar mechanisms of action, allowing a pathogen to resist new treatments without acquiring additional resistance genes.

110. (C) I, III, and IV
Livestock-associated methicillin-resistant Staphylococcus aureus is increasingly identified in swine and poultry, presenting an occupational hazard for farm workers. The mecA gene mediates resistance by encoding an altered penicillin-binding protein with low affinity for beta-lactams. While handling raw meat can transmit LA-MRSA, foodborne ingestion is not considered the primary transmission route for human MRSA infections.

111. (B) Syndromic surveillance monitors health-related data (like pharmacy sales) to detect outbreaks early
Syndromic surveillance is an advanced public health tool that monitors real-time, health-related data, such as over-the-counter medicine sales and hospital admission records, to detect potential disease outbreaks before laboratory confirmation. In contrast, passive surveillance relies on laboratories voluntarily reporting cases, which often leads to underreporting since many infected individuals do not seek medical care.

112. (D) It advocates for the increased use of antibiotics in animals to ensure human food safety
The One Health approach focuses on coordinating efforts across human medicine, veterinary science, and environmental management to address systemic health risks. It does not advocate for increased antibiotic use in animals. Instead, it strongly promotes reducing agricultural antimicrobial use and enhancing stewardship to prevent the emergence and spread of resistant pathogens through the food chain.

113. (D) A is false but R is true.
Freezing is not a reliable method to eliminate protozoan cysts of Giardia lamblia or oocysts of Cryptosporidium parvum from food or water. While ice crystal formation can cause some physical damage to cellular membranes, these transmission stages are highly resistant to environmental extremes. Many cysts remain viable and infectious even after prolonged exposure to sub-zero temperatures.

114. (C) Cryptosporidium - Filtration and immunofluorescence microscopy
Detecting protozoan pathogens like Cryptosporidium in water samples requires specialized techniques because of their low concentration and lack of culturability on standard media. The standard method involves physical filtration of large water volumes, followed by immunofluorescence microscopy. This technique uses specific fluorescently labeled antibodies to bind and visualize the characteristic oocysts under a microscope.

115. (A) Implementing pre-slaughter withdrawal periods for veterinary drugs
The emergence of antimicrobial resistance in agricultural systems is driven by factors like pharmaceutical waste discharge and prophylactic antibiotic use in aquaculture. Conversely, implementing pre-slaughter withdrawal periods is a control measure designed to ensure that veterinary drug residues degrade to safe levels before harvest, thereby reducing consumer exposure to antibiotics and preventing selective pressure on foodborne pathogens.

116. (D) It mimics glutamate, overstimulating specific brain receptors and causing damage
Domoic acid is a potent neurotoxin produced by marine diatoms that causes amnesic shellfish poisoning. Its toxic mechanism is based on its structural similarity to the excitatory neurotransmitter glutamate. It binds strongly to glutamate receptors in the brain, particularly in the hippocampus, causing continuous depolarization and cell death, which clinically manifests as permanent short-term memory loss.

117. (B) Ensuring rapid chilling of fish after catch and maintaining the cold chain
Preventing histamine poisoning in the seafood supply chain requires controlling bacterial growth on harvested fish. Once caught, fish must be rapidly chilled to temperatures below four degrees Celsius and maintained in a continuous cold chain. This temperature control prevents histidine-decarboxylase-producing bacteria from multiplying and converting histidine into toxic, heat-stable histamine.

Downloaded from www.pdf.tube

residing in the bovine intestinal tract. In contrast, soil and dust are natural habitats for Bacillus cereus, warm coastal waters support Vibrio vulnificus, and the ruminant gastrointestinal tract serves as the primary reservoir for Escherichia coli O157:H7.

100. (D) Using antibiotics as standard growth promoters to ensure uniform animal size
To delay the emergence of antimicrobial resistance, agricultural systems must adopt strategies that minimize selective pressure on bacterial populations. These include implementing biosecurity measures, utilizing animal vaccines, and using targeted treatments. Using antibiotics as standard growth promoters is a major driver of resistance, as it exposes bacteria to continuous, sub-lethal drug levels, promoting resistant strains.

101. (B) 3, 4, 2, 1
Ciguatera fish poisoning begins with the growth of benthic dinoflagellates, specifically Gambierdiscus toxicus, on coral reefs. Herbivorous fish graze on these algae and ingest the ciguatoxins. These toxins are then bioaccumulated and biotransformed into more toxic forms as they move up the food chain into large carnivorous reef fish, which are eventually consumed by humans.

102. (C) Ensuring an F_0 value of 3.0 minutes
The regulatory standard for low-acid canned foods requires achieving an F-zero value of at least 3.0 minutes. This parameter represents the equivalent thermal lethality of a process operating at one hundred twenty-one degrees Celsius, designed to ensure a twelve-decimal reduction of Clostridium botulinum spores, thereby preventing botulism outbreaks and achieving commercial sterility.

103. (D) Incubating in a microaerophilic environment at 42°C
To successfully isolate Campylobacter jejuni from poultry swabs, technicians must apply specific cultural requirements. This thermophilic pathogen requires incubation at an elevated temperature of forty-two degrees Celsius, which matches avian body temperature and inhibits competing background flora. Furthermore, it must be incubated in a microaerophilic atmosphere containing reduced oxygen levels to support its metabolism.

104. (C) Statement I is true but Statement II is false
Aflatoxin M1 is a toxic metabolite found in the milk of dairy cows that have ingested feed contaminated with aflatoxin B1, which is metabolized into the M1 form. This metabolite represents a serious public health hazard because it is highly heat-stable. Standard commercial pasteurization processes do not destroy aflatoxin M1, meaning contaminated raw milk remains toxic even after undergoing thermal treatment.

105. (B) Clostridium perfringens
An incubation period of twelve hours, combined with symptoms of abdominal cramps and diarrhea without vomiting or fever, is highly characteristic of Clostridium perfringens food poisoning. Storing roast beef in large, deep pans creates the anaerobic conditions necessary for this spore-former to multiply during slow cooling, leading to high vegetative cell counts that cause infection upon ingestion.

106. (B) Water activity (a_w)
Water activity is the most critical intrinsic factor determining a food product's susceptibility to microbial spoilage and pathogen growth. It measures the water available for chemical and metabolic reactions. Most pathogenic bacteria require a water activity above 0.95 to multiply, while drying or adding solutes lowers this value, effectively inhibiting microbial proliferation and extending shelf life.

107. (A) P-II, Q-I, R-III, S-IV
Foodborne diseases display highly characteristic incubation periods based on their pathogenesis. Staphylococcal food poisoning, caused by preformed toxins, has a rapid onset of one to seven hours. Campylobacteriosis typically requires two to five days. Hepatitis A has a long incubation of fifteen to fifty days, while listeriosis ranges from one to four weeks or longer due to intracellular invasion.

108. (C) Transduction
Transduction is the genetic process by which bacterial DNA, including virulence genes, is transferred from one bacterium to another by a bacteriophage. This mechanism is responsible for the emergence of Shiga toxin-producing Escherichia coli, where non-pathogenic strains acquire the toxin-encoding gene from a temperate phage, transforming them into virulent pathogens capable of causing severe human illness.

NODIA

cattle are natural, asymptomatic reservoirs for Escherichia coli O157:H7, untreated manure often contains high levels of this pathogen. If applied close to harvest, the bacteria can contaminate the leafy surfaces of spinach, causing widespread foodborne outbreaks.

91. (A) Ingestion of encysted larvae that mature in the gut and migrate to muscle
The transmission of Trichinellosis is a direct result of consuming raw or undercooked pork containing encysted larvae of the parasite Trichinella spiralis. Upon ingestion, gastric acid releases the larvae, which mature into adult worms in the small intestine. After mating, newborn larvae enter the lymphatic system and migrate to skeletal muscle tissues, causing severe inflammation.

92. (C) P-II, Q-I, R-IV, S-III
Molecular methods are essential tools for detecting antimicrobial resistance. Whole-genome sequencing provides complete genomic data to identify all known resistance genes. Multiplex PCR amplifies several specific resistance genes in a single reaction. DNA microarrays use hybridization probes to detect specific resistance alleles, while plasmid profiling analyzes the extrachromosomal DNA elements that facilitate resistance gene transfer.

93. (D) The time required at a specific temperature to reduce microbial count by 90%
In thermal food microbiology, the decimal reduction time, or D-value, is defined as the time required at a specific constant temperature to reduce the microbial population by ninety percent, or one log cycle. This parameter is highly specific to the target microorganism, the heating temperature, and the physical characteristics of the food matrix being processed.

94. (C) Formation of attaching and effacing (A/E) lesions on host cells
Enteropathogenic Escherichia coli causes severe diarrheal illness primarily through the formation of characteristic attaching and effacing lesions on host intestinal epithelial cells. The bacteria utilize a bundle-forming pilus to adhere to the mucosa and a type III secretion system to inject effector proteins, leading to microvilli destruction and cytoskeletal rearrangements that impair nutrient and water absorption.

95. (B) I, II, and III
Listeria monocytogenes is a major environmental pathogen in food facilities, notable for forming persistent biofilms on wet surfaces like floor drains and cooling units. Systematic environmental monitoring programs are essential to detect and eliminate these colonization sites. Crucially, standard commercial pasteurization is highly effective at destroying Listeria vegetative cells in raw food products.

96. (D) The toxins are highly heat-resistant and require boiling for hours to be destroyed
Clostridium botulinum neurotoxins are highly potent proteins synthesized as single-chain polypeptides that are subsequently cleaved into active di-chains. Type A is the most common cause of human botulism. Unlike the highly heat-resistant spores, the neurotoxins themselves are heat-labile. They can be completely inactivated by heating the food to eighty degrees Celsius for ten minutes or boiling.

97. (A) Salmonella Typhimurium - Facultative anaerobe
Foodborne pathogens exhibit distinct oxygen requirements that influence their growth and survival. Salmonella Typhimurium is a facultative anaerobe, capable of growing in both oxygen-rich and oxygen-depleted environments. In contrast, Campylobacter jejuni is microaerophilic, Clostridium perfringens is an obligate anaerobe, and Listeria monocytogenes is a facultative anaerobe rather than an obligate anaerobe, allowing survival in diverse conditions.

98. (A) Both A and R are true and R is the correct explanation of A.
The agricultural use of third-generation cephalosporins in poultry select for extended-spectrum beta-lactamase-producing bacteria. Plasmids carrying these ESBL genes can easily transfer horizontally from commensal gut bacteria to pathogenic Salmonella strains within the animal host. When humans consume contaminated poultry, these resistant pathogens can cause severe infections that resist standard beta-lactam antibiotic therapies.

99. (A) Staphylococcus aureus - Bovine intestinal tract
Staphylococcus aureus is primarily associated with the skin, mucous membranes, and nasal cavities of warm-blooded animals and humans, rather than

Click Here to Buy book on Amazon

118. (C) Validating that parameters are scientifically proven to achieve the target log reduction
When reviewing a HACCP plan for cooked meat, food safety officers must verify that the critical limits for the cooking step are scientifically validated. The facility must demonstrate that the selected time and temperature combinations are proven to achieve the required log reduction of target vegetative pathogens, ensuring the process consistently delivers safe products.

119. (D) Statement I is false but Statement II is true
Clostridium perfringens food poisoning requires the ingestion of a large number of viable vegetative cells, which then undergo sporulation in the host's small intestine. Crucially, the enterotoxin is not produced during vegetative growth in food; rather, it is synthesized and released in the gut during the sporulation process, making this a toxin-mediated infection.

120. (A) Shigella sonnei
Shigella sonnei is a highly infectious bacterium capable of causing outbreaks with an extremely low infectious dose of ten to one hundred cells. This low threshold facilitates direct person-to-person transmission, especially in crowded settings like day-care centers. The clinical presentation of severe bloody diarrhea is a hallmark of shigellosis, resulting from invasion of the colonic mucosa.

121. (B) Consuming undercooked meat with tissue cysts, or food contaminated by cat feces
Toxoplasmosis is a parasitic zoonosis caused by the protozoan Toxoplasma gondii. Foodborne transmission primarily occurs through two pathways: consuming undercooked meat containing tissue cysts, or ingesting food or water contaminated with oocysts shed in the feces of infected felines, which are the definitive hosts. This parasite poses a severe risk to fetuses and immunocompromised individuals.

122. (B) P-IV, Q-I, R-II, S-III
Fungal species produce characteristic mycotoxins under specific environmental conditions. Aspergillus flavus produces carcinogenic aflatoxins in peanuts and corn. Penicillium verrucosum synthesizes ochratoxin A in stored cereal grains. Fusarium verticillioides is the primary producer of fumonisins in corn, while Claviceps purpurea infects rye and other small grains, producing toxic ergot alkaloids that cause ergotism.

123. (A) The negative reciprocal of the slope when log survivors are plotted against time
The D-value is mathematically derived from the microbial thermal death time curve. When the logarithm of surviving microorganisms is plotted against heating time at a constant temperature, the resulting relationship is typically linear. The D-value is calculated as the negative reciprocal of the slope of this semi-logarithmic line, representing a one-decimal reduction in population.

124. (C) Cross-contamination from raw poultry to ready-to-eat foods is a major risk factor
Campylobacter species are common colonizers of poultry intestinal tracts. Because the bacterium is highly sensitive to environmental stresses and cannot multiply in raw meat at refrigeration temperatures, its transmission relies heavily on cross-contamination. Transferring the pathogen from raw chicken to ready-to-eat foods via contaminated cutting boards, utensils, or hands is a primary cause of infection.

125. (D) I, II, and III
Antimicrobial resistance surveillance relies on phenotypic and genotypic data collection, including retail meat sampling, to track resistance trends and update treatment guidelines. While phenotypic testing shows susceptibility, it alone is insufficient to track the global spread of specific resistance plasmids. This tracking requires molecular and genomic sequencing to identify plasmid structures and horizontal transmission pathways.

126. (C) Vibrio cholerae thrives in fresh, highly acidic water sources
Vibrio cholerae is highly sensitive to acidic environments and does not survive well in low-pH waters. In contrast, other pathogens exhibit robust survival traits: Salmonella can persist for months in dry products like milk powder, Listeria monocytogenes can tolerate high salt concentrations, and Staphylococcus aureus is exceptionally resistant to drying and high osmotic pressures.

127. (B) Water activity (a_w) - The ratio of the food's vapor pressure to that of pure water
The intrinsic factor water activity is defined as the ratio of the vapor pressure of water in a food system to the vapor pressure of pure water at the same temperature. This parameter ranges from zero to one and indicates the amount of free water

Downloaded from www.pdf.tube

hazards targeted by this standard are Salmonella and Campylobacter species, which are highly prevalent in raw poultry products. Achieving this temperature guarantees a safe log reduction of these heat-sensitive bacterial populations.

147. (A) A persistent environmental biofilm exists, posing a continuous risk of contamination
When environmental swabs in a dairy plant repeatedly test positive for Listeria species while final product tests remain negative, it indicates the presence of a persistent biofilm. This reservoir within the facility poses a constant risk of cross-contamination. If sanitation failures occur, the pathogen can transfer from these niches into the food products before packaging.

148. (D) The ability to assess the speed and accuracy of traceability and recall protocols
When reviewing a facility's outbreak response plan, a food safety officer must evaluate their capacity to trace and recall products. This competency involves assessing the speed and accuracy of the facility's documentation systems in tracking raw materials and final shipments. A rapid, well-coordinated recall is essential to minimize public exposure during a contamination event.

149. (D) Statement I is false but Statement II is true
Mycotoxins are not uniformly distributed throughout a batch of stored grain; instead, they occur in highly concentrated pockets where localized mold growth has occurred. To obtain a representative sample for analysis, sampling protocols must mandate taking multiple incremental samples from different locations in the lot to form a single, homogenized aggregate sample for laboratory testing.

150. (C) Pre-harvest contamination leading to a widespread foodborne outbreak
Contaminating romaine lettuce with pathogens from nearby agricultural runoff is a classic example of pre-harvest contamination. When pathogen-rich water is applied to fields, bacteria can adhere to the rough, folded leafy surfaces of the crops. Since these vegetables are consumed raw, any pre-harvest contamination bypasses subsequent cooking steps, directly causing widespread foodborne outbreaks.

NODIA

proteins, mediate resistance in methicillin-resistant Staphylococcus aureus. Enzymatic inactivation, driven by beta-lactamases, destroys penicillin molecules. Active efflux pumps transport tetracyclines out of the cell, while decreased permeability, through loss of outer membrane porins, prevents drug entry.

138. (B) The temperature change required to alter the D-value tenfold
The Z-value is a fundamental parameter used in thermal food processing calculation. It is defined as the temperature change, in degrees Celsius or Fahrenheit, required to achieve a tenfold, or one log cycle, change in the decimal reduction time. This value reflects the temperature sensitivity of a specific microorganism's thermal death rate in a food matrix.

139. (A) It has a long incubation period up to 70 days, complicating investigations
The epidemiology of Listeria monocytogenes is complicated by its long incubation period, which can range from several days up to seventy days. This delay makes it extremely difficult for public health investigators to obtain accurate dietary histories from patients, slowing down the identification of contaminated food sources and the resolution of outbreaks.

140. (C) I, II, and IV
Escherichia coli O157:H7 is a Shiga toxin-producing pathogen asymptomatically carried in the gastrointestinal tracts of ruminant animals. It differs from other E. coli strains by its inability to ferment sorbitol rapidly. Crucially, antibiotic treatment is not recommended for this infection, as lysing the bacteria can trigger massive toxin release, increasing the risk of hemolytic uremic syndrome.

141. (D) Disc diffusion provides an exact quantitative measure of the antibiotic concentration needed to kill the bacteria
The disc diffusion test is a qualitative or semi-quantitative assay that measures the zone of inhibition to classify bacteria as susceptible, intermediate, or resistant. It does not provide an exact quantitative measure of the antibiotic concentration required to inhibit or kill the pathogen. That quantitative value is instead determined using minimum inhibitory concentration tests.

142. (C) Bacillus cereus emetic toxin (cereulide) - Heat stable
Bacterial toxins vary significantly in their susceptibility to thermal denaturation. The emetic toxin produced by Bacillus cereus, cereulide, is exceptionally heat-stable and can withstand autoclaving temperatures. Conversely, other toxins are heat-labile: Clostridium botulinum neurotoxins and Clostridium perfringens enterotoxins are inactivated by heat, and Staphylococcal enterotoxins are highly heat-resistant rather than heat-labile.

143. (C) A is true but R is false.
Using unpasteurized raw milk for cheese making carries a higher risk of transmitting zoonotic pathogens like Salmonella and Listeria than using pasteurized milk. Pasteurization is designed to eliminate common vegetative pathogens from milk, but it is not intended to destroy highly heat-resistant bacterial endospores, which require higher sterilization temperatures to be completely inactivated.

144. (D) Using the same cutting board for raw chicken and salad - A safe practice if rinsed with cold water
Using the same cutting board for raw chicken and ready-to-eat salad is a high-risk practice that causes cross-contamination. Simply rinsing the board with cold water does not remove or destroy pathogens like Salmonella or Campylobacter on the surface. These bacteria can be transferred directly to the salad, which is consumed without undergoing any subsequent cooking step.

145. (A) Focusing surveillance on clinical human isolates while ignoring environments
The One Health approach to combating antimicrobial resistance requires a collaborative, multi-sectoral strategy. This involves promoting the prudent use of veterinary drugs, implementing biosecurity measures on farms, and developing coordinated surveillance plans across human, animal, and environmental sectors. Restricting surveillance to human clinical isolates while ignoring environmental pathways is contrary to this interconnected framework.

146. (C) Salmonella spp. and Campylobacter spp.
The poultry industry uses a minimum internal temperature critical limit of seventy-four degrees Celsius to ensure the thermal destruction of vegetative enteric pathogens. The primary

Click Here to Buy book on Amazon

available to support essential microbial metabolic processes, growth, and toxin production.

128. (D) A is false but R is true.
Vacuum packaging does not eliminate the risk of all pathogens, as anaerobic environments can stimulate anaerobic spore-formers like Clostridium botulinum. These obligate anaerobes are inhibited by oxygen and can grow and produce potent neurotoxins in low-acid, vacuum-sealed foods if they are temperature-abused, presenting a severe risk that requires additional hurdle technologies.

129. (A) Clostridium perfringens - High fever and bloody stools
Clostridium perfringens food poisoning is characterized by moderate to severe abdominal cramps and watery diarrhea, which typically resolve within twenty-four hours. Fever and bloody stools are not classic clinical symptoms of this infection. Instead, these symptoms are associated with invasive pathogens like Salmonella, Shigella, or enteroinvasive Escherichia coli, which cause structural damage to the mucosal lining.

130. (C) Acceleration of bacterial flagellar motility
Antimicrobial agents used in human and veterinary medicine function by disrupting critical bacterial physiological processes. Classic modes of action include inhibiting cell wall synthesis, disrupting protein synthesis via ribosomal binding, and interfering with nucleic acid replication. Accelerating bacterial flagellar motility is not a mechanism of action for antimicrobials, which are designed to inhibit or kill pathogens.

131. (A) 3, 5, 4, 1, 2
Performing a disc diffusion test begins with preparing a bacterial suspension matching a 0.5 McFarland standard. This suspension is swabbed evenly across a Mueller-Hinton agar plate to create a lawn. Next, antibiotic-impregnated paper discs are applied to the agar. The plate is then incubated, and the resulting zones of inhibition are measured and compared to standard breakpoints.

132. (D) Trace back the dairy herd's feed supply to test for contamination
The presence of aflatoxin M1 in raw milk is a direct consequence of dairy cows consuming feed contaminated with aflatoxin B1, which is metabolized into the M1 form. Because pasteurization does not destroy this stable toxin, food safety officers must trace back the herd's feed supply to identify and eliminate the contaminated agricultural feed source.

133. (B) Using hurdle technology by combining mild heat, lower pH, and preservatives
To produce shelf-stable beverages without extreme heat treatments, food scientists must apply hurdle technology. This strategy combines multiple preservation factors, such as moderate thermal processing, reduced pH below 4.6, and antimicrobial preservatives. Individually, these factors may not ensure stability, but together they create an environment that successfully prevents Clostridium botulinum spore germination and spoilage.

134. (A) Both Statement I and Statement II are true
Whole-genome sequencing has become the gold standard for foodborne disease surveillance. By providing the complete DNA sequence of bacterial isolates, WGS allows public health laboratories to determine genetic relatedness with single-nucleotide precision. This high resolution enables epidemiologists to link isolates from patients and food products across different locations, identifying outbreaks that traditional methods might miss.

135. (D) Hepatitis A virus
Hepatitis A virus is a non-enveloped virus that causes acute liver inflammation, clinically presenting as jaundice, fatigue, and abdominal pain. It is transmitted via the fecal-oral route and is frequently linked to consuming raw bivalve mollusks, such as oysters, harvested from sewage-polluted waters. These filter feeders concentrate viral particles from the water within their tissues.

136. (A) Horizontal gene transfer facilitated by high cell density and plasmids
The rapid dissemination of antimicrobial resistance within wastewater treatment plants is a direct result of horizontal gene transfer. The high cell density and diverse microbial populations in these environments provide optimal conditions for conjugation, where resistance plasmids are transferred directly between different bacterial species, rapidly creating new multi-drug resistant strains in the aquatic ecosystem.

137. (B) P-II, Q-I, R-IV, S-III
Bacteria employ distinct biochemical mechanisms to resist antibiotic treatments. Target site modifications, such as altered penicillin-binding

NODIA

CHAPTER 10

Sources of Microorganisms and Microbiological Quality of Foods

1. Which of the following best defines a primary source of microbial contamination in food?
(A) Contamination from the natural environment where food is grown or reared.
(B) Contamination introduced during high-speed packaging and labeling processes.
(C) Contamination resulting from poor personal hygiene of plant food handlers.
(D) Contamination caused by inadequate sanitation of raw slicing machinery.

2. Which bacterial pathogen is most predominantly recognized as a ubiquitous soil-borne contaminant affecting raw agricultural commodities?
(A) Vibrio parahaemolyticus
(B) Salmonella Typhi
(C) Bacillus cereus
(D) Campylobacter jejuni

3. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): Surface water is generally considered to have a higher microbial load and greater variability than deep groundwater.
Reason (R): Surface water is directly exposed to atmospheric fallout, agricultural runoff, and animal waste.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

4. Which of the following statements regarding air as a source of microbial contamination is correct?
(A) Airborne microorganisms primarily exist in a free-floating state independent of dust or moisture droplets.
(B) Gram-negative bacteria are generally more resistant to desiccation in aerosolized forms than Gram-positive spores.
(C) Fungal spores settle rapidly from the air and are rarely responsible for contamination in well-ventilated facilities.
(D) Air serves strictly as a transport medium and does not support the active multiplication of microorganisms.

5. Which of the following statements incorrectly describes the natural microflora of raw materials?
(A) The internal tissues of healthy living plants and animals are generally considered sterile.
(B) The microflora on fresh produce strictly reflects pathogens of the seed cultivar.
(C) Soil contact significantly influences the external microbial composition of root vegetables.
(D) The physical structure of a raw material can protect certain microorganisms from environmental stress.

6. Match the primary environmental source in List I with its typically associated microorganism in List II:
List I: (Environmental Source)
P. Soil
Q. Water
R. Air
S. Animal intestinal tract
List II: (Microorganism)
I. Micrococcus species
II. Escherichia coli
III. Clostridium botulinum
IV. Vibrio cholerae
(A) P-III, Q-IV, R-I, S-II
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-III, Q-I, R-IV, S-II

7. Which of the following pairs of raw material and its common primary microbial contaminant is correct?
(A) Marine fish – Listeria monocytogenes

Downloaded from www.pdf.tube

Plate Count Agar

69. Consider the following limitations of Total Viable Count (TVC) testing:
1. It does not differentiate between harmless spoilage organisms and severe pathogens.
2. It completely fails to detect microorganisms that are in a Viable But Non-Culturable (VBNC) state.
3. The results heavily depend on the specific agar medium and incubation temperature chosen.
4. It requires complex DNA sequencing equipment for basic enumeration.

Which of the statements given above are correct?
(A) 1, 2 and 3
(B) 1, 3 and 4
(C) 2, 3 and 4
(D) 1 and 2

70. Which of the following types of microorganisms is generally NOT evaluated or captured by a standard Total Plate Count (TPC) performed aerobically at 35°C for 48 hours?
(A) Mesophilic aerobic bacteria
(B) Facultative anaerobic bacteria
(C) Obligate thermophilic archaea
(D) Common environmental coliforms

71. Direction: Read the statements given below and select the correct option.
Statement I: An exceptionally low TVC in a heavily processed food product guarantees that no microbial toxins are present.
Statement II: Microbial toxins, such as those from Staphylococcus aureus, can persist in food even after the producing cells have been destroyed by processing.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

72. Arrange the following events in the typical order of microbial shift during the aerobic spoilage of fresh raw meat stored at 4°C:
1. Depletion of surface glucose by Pseudomonas species
2. Initial low-level presence of a mixed microflora including mesophiles and psychrotrophs
3. Rapid exponential growth and dominance of Pseudomonas species
4. Utilization of amino acids resulting in the production of foul-smelling ammonia and amines

(A) 2, 3, 1, 4
(B) 2, 1, 3, 4
(C) 1, 3, 2, 4
(D) 3, 2, 4, 1

73. A batch of pasteurized milk exhibits an unusually high TVC immediately after processing, yet phosphatase tests confirm the pasteurization temperature and time were adequate. What is the most likely explanation?
(A) The milk was severely contaminated with psychrotrophic yeasts.
(B) The raw milk contained high numbers of thermoduric bacteria.
(C) The pasteurizer effectively eradicated all bacterial spores.
(D) The milk was subjected to extreme post-pasteurization freezing.

74. What is the primary reason why Pseudomonas species easily outcompete other microflora and cause rapid spoilage of fresh meat stored aerobically at chilling temperatures?
(A) They are strict anaerobes that thrive in the absence of oxygen.
(B) They grow very rapidly at refrigeration temperatures.
(C) They produce high levels of lactic acid that rapidly lowers the meat pH.
(D) They possess thick endospores that resist the cold environment.

75. A food safety officer receives a TVC result of 1.5×10^7 CFU/g for a sample of raw ground beef. Applying standard microbiological principles, what conclusion can be drawn regarding its quality?
(A) The beef is at the threshold of incipient spoilage.
(B) The beef is of exceptionally high quality and safe for raw consumption.
(C) The beef has been properly sterilized using high-pressure processing.
(D) The TVC level indicates the precise concentration of Salmonella present.

NODIA

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

(A) Utilizing overhead sprinkler systems with surface pond water
(B) Employing plastic mulch and subsurface drip irrigation
(C) Broadcasting untreated animal manure directly over the fruiting plants
(D) Harvesting the fruit immediately after heavy natural rainfall

16. What defines a secondary source of microbial contamination in food processing?
(A) Contamination originating from the natural environment of the agricultural field.
(B) Contamination strictly caused by airborne dust settling on raw agricultural commodities.
(C) Contamination resulting directly from the internal organs of a slaughtered animal.
(D) Contamination introduced during the processing or packaging of the food product.

17. Which specific structure allows certain foodborne bacteria, such as Pseudomonas and Listeria, to irreversibly attach to processing equipment and resist cleaning?
(A) Extracellular polymeric substance (EPS) matrix
(B) Flagellar structures used for active bacterial motility
(C) Rigid peptidoglycan layers of the bacterial cell wall
(D) Lipopolysaccharide components of the outer cell membrane

18. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): Potable water used as an ingredient in food processing must be free of pathogenic microorganisms.
Reason (R): Water can serve as an effective vehicle for the widespread distribution of pathogens throughout a food processing facility.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

19. Which of the following statements regarding food packaging as a secondary source of contamination is correct?
(A) Static electricity on plastic packaging films can attract airborne microbial contaminants.
(B) Cardboard packaging materials inherently possess bactericidal properties that eliminate microbial risks.
(C) Glass containers are highly porous and readily allow the migration of external bacteria into the food.
(D) Vacuum packaging completely eliminates the possibility of any microbial survival on the packaging material.

20. Which of the following statements incorrectly characterizes the microbiological quality of water used in food processing?
(A) Indicator organisms are used to assess the potential presence of enteric pathogens in processing water.
(B) Water used for chilling poultry carcasses can become a major reservoir for cross-contamination.
(C) The presence of Escherichia coli in water is a definitive indicator of recent fecal contamination.
(D) Chlorination guarantees the complete destruction of all protozoan cysts in municipal water supplies.

21. Match the secondary contamination vector in List I with its associated characteristic in List II:
List I: (Secondary Contamination Vector)
P. Food Handlers
Q. Conveyor Belts
R. Packaging Material
S. Ice used for cooling
List II: (Characteristic)
I. Can harbor pathogens if made from unchlorinated water
II. Capable of carrying Staphylococcus aureus in nasal passages
III. Can generate static charges attracting dust and microbes
IV. Prone to biofilm formation in hard-to-clean crevices
(A) P-II, Q-IV, R-III, S-I
(B) P-I, Q-III, R-IV, S-II
(C) P-IV, Q-II, R-I, S-III
(D) P-II, Q-I, R-III, S-IV

22. Which of the following pairs correctly relates a water quality indicator to its primary significance?
(A) Total Coliforms – Exclusive indicator of

Click Here to Buy book on Amazon

animal manure contamination
(B) Fecal Streptococci – Indicator of viral contamination in deep wells
(C) Escherichia coli – Reliable indicator of recent fecal pollution
(D) Pseudomonas aeruginosa – Indicator of heavy metal toxicity

23. Which of the following pairs incorrectly links a secondary source with its primary contamination mechanism?
(A) Slicing machine – Direct contact with food surfaces
(B) Worker clothing – Transfer of lint and trapped microbes
(C) Floor drains – Splashing contaminated aerosols during cleaning
(D) Chiller water – Airborne aerosolization of dry spores

24. Consider the following statements regarding biofilms on food processing equipment:
1. Biofilms can protect embedded bacteria from chemical sanitizers like hypochlorite.
2. Smooth, un-scratched stainless steel completely prevents the initial attachment of biofilm-forming bacteria.
3. The maturation phase of a biofilm involves the dispersion of planktonic cells into the environment.
4. Hot water sanitization is completely ineffective against established biofilms.

Which of the statements given above are correct?
(A) 1 and 3
(B) 1, 2 and 3
(C) 2 and 4
(D) 3 and 4

25. Which of the following represents an exception to standard potable water quality requirements in a food processing plant?
(A) Water used for direct incorporation into the food product
(B) Water used in closed-loop refrigeration cooling towers
(C) Water used for the final rinse of sanitized processing equipment
(D) Water used for washing the hands of food handlers

26. Direction: Read the statements given below and select the correct option.
Statement I: Water utilized for steam production that will come into direct contact with food must meet potable water standards.
Statement II: Boiler water additives used in steam production are not regulated as long as the steam is heated above 100 degrees Celsius.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

NODIA

27. Which of the following is the most appropriate strategy to prevent secondary contamination from food packaging materials?
(A) Storing empty containers inverted in a clean, protected environment
(B) Storing packaging materials in an open, highly ventilated loading dock
(C) Sterilizing all corrugated cardboard boxes with high-pressure steam before use
(D) Washing plastic packaging films with untreated well water prior to filling

28. A cluster of Listeriosis cases is traced back to a specific brand of sliced deli meat. Plant records show that the meat was thoroughly cooked to a safe temperature before slicing. What is the most likely source of the pathogen?
(A) Survival of the bacteria in the raw meat despite thermal processing
(B) Contamination of the spices added before the cooking step
(C) Post-lethality cross-contamination from slicing equipment biofilms
(D) Use of contaminated irrigation water during the growth of the animal feed

29. What is a common effect of high organic matter concentration in the water used for washing vegetables in a continuous flume system?
(A) It drastically increases the efficacy of chlorine-based sanitizers.
(B) It induces the spontaneous destruction of bacterial cell walls.
(C) It prevents the formation of biofilms on the flume surfaces.
(D) It causes rapid depletion of free available chlorine.

30. When designing a new food processing facility, an engineer specifies the use of smooth, non-porous materials for all food-contact surfaces and eliminates sharp internal corners. What underlying microbiological concept is this design applying?
(A) Enhancement of competitive exclusion among native microflora
(B) Promotion of rapid evaporation to decrease overall water activity
(C) Minimization of niches for organic residue and biofilm formation
(D) Amplification of electrostatic repulsion between bacterial cells and surfaces

31. How is a 'clean room' formally defined in the context of the food industry?
(A) A room where the temperature and humidity are maintained at ambient outdoor levels.
(B) An enclosed space where particulate and microbial levels are controlled.
(C) A processing area designated exclusively for washing heavy equipment with high-pressure hoses.
(D) An unregulated storage area for finished, hermetically sealed canned products.

32. What standard filtration technology is universally mandated for controlling airborne microorganisms in high-care food industry clean rooms?
(A) Activated carbon filters
(B) Reverse osmosis membranes
(C) Coarse fiberglass mesh filters
(D) HEPA filters

33. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): Positive air pressure is deliberately maintained in clean rooms relative to adjacent, less clean areas.
Reason (R): Positive pressure ensures that when doors are opened, air flows outward, preventing the ingress of contaminated air.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

34. Which of the following statements correctly differentiates between impaction and impingement in air microbiology?
(A) Impingement relies on gravitational settling, whereas impaction uses electrostatic precipitation.
(B) Impaction is only used for detecting viruses, whereas impingement is exclusively for fungi.
(C) Impaction collects on solid agar, whereas impingement collects into a liquid.
(D) Impingement requires a HEPA filter, whereas impaction requires a UV light source.

NODIA

35. Which of the following statements incorrectly describes the use of settle plates in air microbiology?
(A) They provide a highly quantitative measure of microbes per cubic meter.
(B) They are a passive method relying on the gravitational deposition of particles.
(C) They are highly influenced by air currents and turbulence in the room.
(D) They typically underestimate the presence of smaller, lighter microbial particles.

36. Match the air sampling technique in List I with its operational principle in List II:
List I: (Air Sampling Technique)
P. Settle Plate
Q. Slit Sampler
R. Liquid Impinger
S. Filtration
List II: (Operational Principle)
I. Draws air through a narrow opening onto a rotating agar plate
II. Traps microorganisms within a porous membrane matrix
III. Accelerates air into a liquid broth to capture microbes
IV. Relies purely on gravity for particles to fall onto agar
(A) P-IV, Q-I, R-III, S-II
(B) P-I, Q-IV, R-II, S-III
(C) P-IV, Q-III, R-I, S-II
(D) P-II, Q-I, R-IV, S-III

37. Which of the following pairs correctly relates a clean room parameter with its intended microbiological control function?
(A) High humidity – Accelerates the desiccation of airborne fungal spores
(B) UVGI – Damages microbial DNA to prevent replication

Staphylococcus aureus
(B) Wearing a hairnet – Introduction of Bacillus cereus spores
(C) Failing to wash hands after toilet use – Introduction of Norovirus and E. coli
(D) Wearing heavily soiled aprons – Cross-contamination of Listeria monocytogenes

54. Consider the following statements regarding the microflora of raw vegetables:
1. Vegetables possess a near-neutral pH, making them susceptible to a wide range of bacterial spoilage.
2. The high oxidation-reduction potential of fresh vegetables strictly limits the growth of aerobic organisms.
3. Soil splashing during heavy rains increases the microbial load on leafy greens.
4. Washing vegetables solely with water is sufficient to remove all internalized pathogens.

Which of the statements given above are correct?
(A) 1 and 3
(B) 1, 2 and 4
(C) 2 and 3
(D) 3 and 4

55. Which of the following organisms is NOT typically recognized as a primary part of the naturally occurring microflora on freshly harvested wheat grains?
(A) Fusarium species
(B) Alternaria species
(C) Cladosporium species
(D) Vibrio cholerae

56. Direction: Read the statements given below and select the correct option.
Statement I: Transient flora on a food handler's hands are loosely attached and can easily be removed by routine handwashing.
Statement II: Resident flora are highly pathogenic to the host handler and must be eradicated daily using strong iodine-based sanitizers.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

57. Under which of the following conditions is it most appropriate to completely exclude a food handler from a food preparation facility?
(A) When the handler has a mild, non-infectious allergic reaction
(B) When the handler is experiencing acute diarrhea and vomiting
(C) When the handler reports a minor headache with no fever
(D) When the handler is wearing a brightly colored, unapproved hairnet

58. A large batch of potato salad caused rapid-onset food poisoning (nausea and vomiting within 2 hours of consumption) at a picnic. The potatoes were boiled thoroughly, mixed with mayonnaise, and handled by an employee with a bandaged cut on their finger. What is the most likely cause of the outbreak?
(A) Spores of Clostridium perfringens surviving the boiling process
(B) Heat-stable enterotoxin produced by Staphylococcus aureus
(C) Mycotoxins produced by molds growing in the mayonnaise
(D) Shiga toxin produced by Escherichia coli O157:H7

59. What is the primary microbial effect of immediately drying harvested cereal grains to a water activity (aw) below 0.65?
(A) It prevents storage mold proliferation and mycotoxin production.
(B) It permanently sterilizes the grain, eliminating all bacterial endospores.
(C) It causes the rapid multiplication of halophilic bacteria.
(D) It induces the germination of field fungi spores.

60. To mitigate the risk of pathogen internalization in tomatoes during the washing process in a packinghouse, what specific parameter must be carefully controlled?
(A) Ensuring the wash water is significantly colder than the core temperature of the tomatoes.
(B) Ensuring the washing environment has a relative humidity of exactly 50%.
(C) Ensuring the wash water temperature is at least 10°F warmer than the tomatoes.
(D) Ensuring the wash water contains high concentrations of heavy metal ions.

Downloaded from www.pdf.tube

The resulting plate shows 50 colonies. Applying the concept of quantitative air monitoring, what is the airborne microbial load in CFU per cubic meter?
(A) 5 CFU/m^3
(B) 100 CFU/m^3
(C) 500 CFU/m^3
(D) 50 CFU/m^3

46. In the context of the food industry, what does the term 'resident flora' refer to regarding personal hygiene?
(A) Microorganisms temporarily acquired by touching contaminated surfaces.
(B) Pathogenic bacteria that specifically reside on the surfaces of processing equipment.
(C) Deeply embedded skin microorganisms that are difficult to remove by handwashing.
(D) Spoilage organisms that multiply rapidly on raw materials during storage.

47. Which pathogenic microorganism is most famously associated with contamination from the nasal passages, throat, and skin lesions of food handlers?
(A) Clostridium botulinum
(B) Staphylococcus aureus
(C) Campylobacter jejuni
(D) Vibrio parahaemolyticus

48. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): The physical friction generated during handwashing is just as critical as the soap used.
Reason (R): Friction helps dislodge transient microorganisms, organic matter, and oils from the skin surface.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

49. Which of the following statements regarding the microflora of raw fruits is correct?
(A) The low pH of most fruits primarily favors yeasts and molds.
(B) Fruits generally possess a high pH, which exclusively favors the growth of putrefactive bacteria.
(C) Intact fruit skins are highly permeable, allowing rapid invasion by strictly anaerobic bacteria.
(D) The natural microflora of citrus fruits is dominated by halophilic archaea.

50. Which of the following statements incorrectly characterizes the microflora of cereal grains?
(A) Field fungi on grains typically require high moisture levels for growth before harvest.
(B) Storage fungi, such as Aspergillus and Penicillium, can proliferate at lower water activities.
(C) Lactic acid bacteria are completely absent from the natural microflora of harvested grains.
(D) Contamination of grains can occur through soil, air, and insects during cultivation.

51. Match the raw material in List I with its typically dominant spoilage microflora in List II:
List I: (Raw Material)
P. Fresh Meat
Q. Raw Milk
R. Citrus Fruits
S. Cereal Grains
List II: (Dominant Spoilage Microflora)
I. Penicillium and Aspergillus species
II. Pseudomonas and Acinetobacter
III. Lactococcus and Lactobacillus
IV. Saccharomyces and various molds
(A) P-II, Q-III, R-IV, S-I
(B) P-III, Q-II, R-I, S-IV
(C) P-II, Q-IV, R-III, S-I
(D) P-I, Q-III, R-II, S-IV

NODIA

52. Which of the following pairs identifies a raw material and its characteristic spoilage manifestation caused by microorganisms?
(A) Cured Meats – Rapid mold growth caused by Pseudomonas species
(B) Raw Milk – Green rot caused by Salmonella species
(C) Apples – Putrefaction caused by Clostridium botulinum
(D) Vegetables – Bacterial soft rot caused by Erwinia species

53. Which of the following pairs incorrectly matches a food handler's poor hygiene practice with its primary microbial consequence?
(A) Sneezing over food – Introduction of

(C) Air handling unit (AHU) – Reduces the total volume of air exchanges to trap microbes
(D) Negative pressure – Excludes contaminated air from entering the clean zone

38. Which of the following pairs incorrectly correlates a clean room classification with its stringency level according to ISO standards?
(A) ISO Class 3 – Extremely low allowable particle count
(B) ISO Class 5 – Equivalent to the older Federal Standard Class 100
(C) ISO Class 8 – More stringent than ISO Class 5 for airborne particles
(D) ISO Class 9 – Typical room air standard with minimal particulate control

39. Consider the following statements regarding air microbiology and clean-room standards:
1. The human body is one of the most significant sources of particulate and microbial contamination in a clean room.
2. HEPA filters are designed to capture particles down to 0.3 micrometers with 99.97% efficiency.
3. Increasing the number of air changes per hour (ACH) generally decreases the airborne microbial load.
4. Active air sampling involves exposing agar plates without drawing a measured volume of air.

Which of the statements given above are correct?
(A) 1, 2 and 3
(B) 1, 2 and 4
(C) 2, 3 and 4
(D) 1 and 3

40. Which of the following factors does NOT typically influence the survival of microorganisms suspended in the air?
(A) Nutritional composition of the air
(B) Relative humidity of the environment
(C) Exposure to ultraviolet radiation
(D) Temperature of the ambient air

41. Direction: Read the statements given below and select the correct option.
Statement I: The primary purpose of gowning procedures in a clean room is to protect the operator from hazardous food ingredients.
Statement II: Proper clean room garments act as a physical barrier to contain skin flakes and microorganisms shed by the operator.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

42. Arrange the following steps in the correct sequence for an employee entering a high-care clean room facility:
1. Donning a sterile hairnet and face mask
2. Putting on dedicated clean room footwear or shoe covers
3. Washing and sanitizing hands thoroughly
4. Walking through the airlock or air shower system

(A) 3, 1, 2, 4
(B) 1, 3, 2, 4
(C) 2, 1, 3, 4
(D) 3, 2, 1, 4

43. A bakery's slicing and packaging room is experiencing an unusually high rate of mold contamination on bread loaves. Airflow analysis reveals that air is flowing from the raw ingredient mixing area into the packaging room. What is the fundamental clean-room principle being violated?
(A) Maintenance of positive pressure in high-risk areas
(B) Utilization of UV lighting in the mixing area
(C) Maintenance of high relative humidity in the packaging room
(D) Implementation of ATP swabbing on the baking ovens

44. What is the direct effect of maintaining excessively high relative humidity within a food packaging clean room?
(A) It causes airborne viruses to rapidly lose infectivity due to oxidative stress.
(B) It drastically increases the efficiency of HEPA filters in capturing dry dust particles.
(C) It promotes surface condensation, creating micro-environments for growth.
(D) It forces all airborne bacteria into an immediate viable but non-culturable (VBNC) state.

45. A quality manager uses an active air sampler drawing 100 liters of air per minute for 10 minutes.

Click Here to Buy book on Amazon

61. What does the term Total Viable Count (TVC) represent in microbiological quality evaluation?
(A) The exact count of every single living microorganism, including unculturable ones, in a food sample.
(B) An estimate of the total number of specific pathogenic bacteria present in a sample.
(C) The total mass of microbial DNA extracted from a food matrix.
(D) An estimate of live, culturable heterotrophic microbes under specific incubation conditions.

62. Which bacterial genus predominantly comprises the psychrotrophic microflora responsible for the spoilage of raw milk stored at refrigeration temperatures?
(A) Lactobacillus
(B) Streptococcus
(C) Pseudomonas
(D) Micrococcus

63. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): While pasteurization kills most vegetative bacterial cells in raw milk, the milk can still spoil during refrigerated storage.
Reason (R): Psychrotrophic bacteria in raw milk produce heat-stable extracellular proteases and lipases that survive pasteurization.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

64. Which of the following statements regarding the microflora of raw meat is correct?
(A) The hide and intestines of the animal have minimal impact on the microbial load of the carcass.
(B) Aerobic packaging of fresh meat strictly selects for the growth of strict anaerobes like Clostridium.
(C) Lactic acid bacteria are never found naturally on fresh meat surfaces.
(D) The deep muscle tissue of a healthy, unstressed animal is generally sterile prior to slaughter.

NODIA

65. Which of the following statements incorrectly represents the utility of the Total Plate Count (TPC) as a quality indicator?
(A) TPC provides a direct and immediate correlation with the presence of severe foodborne pathogens like Salmonella.
(B) A high TPC indicates poor hygienic practices or temperature abuse during food handling.
(C) TPC can be used to predict the remaining shelf life of a highly perishable food product.
(D) Standard TPC methods typically fail to enumerate obligate anaerobes and psychrophiles if incubated aerobically at 35°C.

66. Match the raw meat spoilage manifestation in List I with its primary causative microorganism in List II:
List I: (Raw Meat Spoilage Manifestation)
P. Slime formation on aerobic surfaces
Q. Souring and greening of vacuum-packaged meat
R. "Bone taint" or deep tissue putrefaction
S. "Whiskers" or fuzzy growth on aged beef
List II: (Causative Microorganism)
I. Clostridium species
II. Thamnidium species
III. Pseudomonas species
IV. Lactobacillus species
(A) P-III, Q-IV, R-I, S-II
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-III, Q-I, R-IV, S-II

67. Which of the following pairs correctly relates a dairy product spoilage defect with its primary causative agent?
(A) Sweet curdling of milk – Bacillus species
(B) Ropiness in milk – Penicillium species
(C) Blue discoloration of cheese – Pseudomonas syncyanea
(D) Both (A) and (C)

68. Which of the following pairs incorrectly correlates a microbiological quality parameter with its defining characteristic?
(A) TVC at 35°C – Enumerates mesophilic bacteria
(B) Coliform count – Indicates potential sanitary failure
(C) Psychrotrophic count – Incubated typically at 7°C for 10 days
(D) Yeast and Mold count – Evaluated using

(B) Cereal grains – Vibrio vulnificus
(C) Raw milk – Clostridium perfringens
(D) Fresh eggs – Salmonella Enteritidis

8. Which of the following pairs incorrectly matches the primary contamination source with its specific environmental factor?
(A) Air – Dissolved oxygen concentration
(B) Soil – Moisture retention capacity
(C) Irrigation Water – Fecal coliform density
(D) Animal Hides – Manure adherence

9. Consider the following statements regarding primary contamination sources:
1. Dust storms can transport viable bacterial spores over hundreds of kilometers, affecting crops.
2. Contaminated irrigation water applied via drip irrigation poses a higher microbial risk to leafy greens than overhead sprinklers.
3. Soil amendments like improperly composted manure are a major vector for enteric pathogens.
4. Airborne phages are incapable of affecting the microbial starter cultures used in dairy processing.

Which of the statements given above are correct?
(A) 1 and 2
(B) 1 and 3
(C) 2, 3 and 4
(D) 1, 3 and 4

10. Which of the following environments is generally NOT considered a primary source of microbial contamination for fresh produce?
(A) Agricultural soil in the growing field
(B) Sorting tables in the packhouse
(C) Surface irrigation water from nearby rivers
(D) Wildlife traversing the agricultural farm

11. Direction: Read the statements given below and select the correct option.
Statement I: The microbial profile of soil is static and remains unaffected by seasonal variations or agricultural practices.
Statement II: Pathogens like Listeria monocytogenes can survive in soil environments for extended periods, acting as a continuous source of contamination.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

12. Arrange the following events in the correct chronological order detailing the progression of primary contamination from an environmental source to the consumer:
1. Harvest of the crop with contaminated soil adhered to the surface
2. Ingestion of the contaminated raw produce by the consumer
3. Application of improperly composted manure to agricultural soil
4. Survival of enteric pathogens on the plant surface during field growth

(A) 3, 4, 1, 2
(B) 1, 3, 4, 2
(C) 3, 1, 4, 2
(D) 4, 3, 1, 2

13. A farm experiences an outbreak of E. coli O157:H7 linked to its romaine lettuce. Investigations reveal that the lettuce was grown in a field adjacent to a large cattle ranch. What is the most probable pathway of this primary contamination?
(A) Airborne transmission of fungal spores from the cattle feed
(B) Cross-contamination via shared harvesting machinery
(C) Direct contact between the cattle and the processing facility workers
(D) Runoff of cattle manure into the farm's irrigation water source

14. What is the direct effect of utilizing untreated municipal sewage sludge as a fertilizer on agricultural lands?
(A) Complete eradication of native soil microflora due to heavy metals
(B) Immediate reduction in the biological oxygen demand of the surrounding air
(C) Significant increase in the load of human enteric pathogens in the soil
(D) Spontaneous generation of heat-resistant endospores within the plant tissue

15. An agronomist wants to minimize the microbial risk to a strawberry crop grown in soil known to harbor high levels of natural microflora. Which application technique minimizes the primary contamination risk?

Downloaded from www.pdf.tube

76. In microbiological quality evaluation, what is the defining characteristic of a differential medium?
(A) It contains substances that selectively inhibit the growth of all Gram-negative bacteria.
(B) It is formulated with minimal nutrients to strictly starve non-target organisms.
(C) It contains indicators that distinguish microbes based on biochemical traits.
(D) It strictly utilizes extreme pH levels to isolate extremophiles.

77. Which widely used selective and differential agar is typically employed for the enumeration of coliforms in food and water samples?
(A) Baird-Parker Agar
(B) Potato Dextrose Agar (PDA)
(C) Xylose Lysine Deoxycholate (XLD) Agar
(D) Violet Red Bile Agar (VRBA)

78. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): Membrane filtration is frequently preferred over standard pour plates for analyzing the microbiological quality of treated municipal water.
Reason (R): Membrane filtration allows for the concentration of microorganisms from large volumes of liquid with very low expected microbial counts.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

79. Which of the following statements correctly differentiates between the pour plate and spread plate methods?
(A) The spread plate method embeds microorganisms within the agar, restricting the growth of obligate aerobes.
(B) The pour plate method can subject heat-sensitive microbes to thermal shock.
(C) The spread plate allows for the plating of sample volumes up to 5 mL directly onto the agar surface.
(D) The pour plate method strictly requires the use of a glass spreader and a rotating turntable.

80. Which of the following statements incorrectly describes the membrane filtration technique used in food microbiology?
(A) It is highly effective for clear, non-turbid liquid samples like drinking water or clear beverages.
(B) The standard pore size utilized to trap most bacteria is 0.45 micrometers.
(C) After filtration, the membrane filter is aseptically transferred directly onto the surface of an agar plate or absorbent pad.
(D) It is exceptionally well-suited for highly viscous foods like peanut butter or thick gravies.

81. Match the culture medium in List I with its target microorganism in List II:
List I: (Culture Medium)
P. Baird-Parker Agar
Q. Thiosulfate-Citrate-Bile Salts-Sucrose (TCBS) Agar
R. Dichloran Rose Bengal Chloramphenicol (DRBC) Agar
S. Sorbitol MacConkey (SMAC) Agar
List II: (Target Microorganism)
I. Yeasts and Molds
II. Vibrio species
III. Escherichia coli O157:H7
IV. Staphylococcus aureus
(A) P-IV, Q-II, R-I, S-III
(B) P-I, Q-III, R-IV, S-II
(C) P-IV, Q-I, R-II, S-III
(D) P-II, Q-IV, R-I, S-III

NODIA

82. Which of the following pairs correctly relates a selective agent in a culture medium to its primary inhibitory function?
(A) Bile salts – Inhibits the growth of Gram-negative enteric bacteria
(B) Chloramphenicol – Promotes the rapid swarming of Proteus species
(C) Crystal violet – Inhibits the growth of Gram-positive bacteria
(D) Sodium chloride (at 7.5%) – Inhibits the growth of Staphylococcus species

83. Which of the following pairs incorrectly matches an indicator dye or system with its corresponding culture medium?
(A) Bromothymol blue – PDA
(B) Neutral red – MacConkey Agar
(C) Phenol red – Mannitol Salt Agar
(D) Eosin and Methylene Blue – EMB Agar

84. Consider the following characteristics regarding the pour plate method:
1. It is capable of accommodating larger sample volumes (e.g., 1.0 mL) compared to standard spread plating.
2. Microcolonies that grow deep within the agar tend to be smaller and lens-shaped.
3. It is the optimal method for observing the natural morphology, color, and sporulation patterns of molds.
4. Molten agar must be cooled to approximately 45°C before pouring to minimize thermal lethality to microbes.

Which of the statements given above are correct?
(A) 1, 2 and 4
(B) 1, 3 and 4
(C) 2, 3 and 4
(D) 1 and 2

85. Which of the following is NOT a recognized limitation of traditional culture-dependent microbiological methods?
(A) They require significant time (often 24 to 72 hours) to yield definitive results.
(B) They allow for the isolation of pure cultures for downstream antimicrobial susceptibility testing.
(C) They are entirely unable to detect living cells that are in a Viable But Non-Culturable (VBNC) state.
(D) They necessitate the destruction of the food matrix, preventing the resale of the sampled item.

86. Direction: Read the statements given below and select the correct option.
Statement I: Severely stressed or sub-lethally injured cells in a food sample may fail to form colonies on highly selective agar media.
Statement II: A pre-enrichment step in a non-selective broth is often utilized to allow injured pathogens to resuscitate before selective plating.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

87. Which plating technique is the most appropriate when an analyst needs to enumerate strictly aerobic, highly heat-sensitive bacteria from a 0.1 mL liquid food sample?
(A) Pour plate method
(B) Most Probable Number (MPN) multiple-tube method
(C) Streak plate method on differential agar
(D) Spread plate method

88. A technician enumerating bacteria from a food sample counts 450 colonies on a plate inoculated with a 10^{-2} dilution, and 45 colonies on a plate with a 10^{-3} dilution. According to standard microbiological guidelines, what is the most appropriate action?
(A) Use the 10^{-3} plate because the 10^{-2} plate exceeds the valid counting range.
(B) Calculate the CFU/g using the 10^{-2} plate because it has more colonies, ensuring higher accuracy.
(C) Average the counts from both plates without adjusting for the dilution factor.
(D) Report the sample as 'Too Numerous To Count' (TNTC) and request a new sample.

89. What is the cause-and-effect relationship of applying an excessively hot (e.g., 60°C) molten agar over a sample during the pour plate procedure?
(A) Complete elimination of interfering air bubbles, leading to perfect plate readability.
(B) Thermal shock and lethality to vegetative cells, reducing the overall count.
(C) Immediate hyper-proliferation of psychrotrophic bacteria due to heat activation.
(D) Spontaneous transformation of harmless bacteria into pathogenic strains.

90. An analyst needs to test a thick, highly turbid fruit pulp for coliforms. Knowing that membrane filtration is unsuitable, and the expected count is very low (< 10 CFU/g), what concept application ensures the best quantitative result?
(A) Diluting the sample heavily to 10^{-6} and using the spread plate method.
(B) Using the Most Probable Number (MPN) method.
(C) Using a settling plate in the room where the pulp was processed.
(D) Autoclaving the pulp prior to plating to clarify the liquid.

Click Here to Buy book on Amazon

91. In standard mycological media like Potato Dextrose Agar (PDA), what is the primary purpose of adding a specific concentration of sterile tartaric acid?
(A) To lower the medium pH to approximately 3.5, suppressing bacterial growth.
(B) To provide an essential carbon source specifically utilized by molds.
(C) To act as a visible pH indicator that changes color when yeast ferments dextrose.
(D) To induce sporulation in otherwise non-sporulating vegetative fungal mycelia.

92. Which foodborne virus is most frequently implicated globally in large-scale outbreaks of non-bacterial gastroenteritis associated with infected food handlers?
(A) Hepatitis A virus
(B) Rotavirus
(C) Norovirus
(D) Astrovirus

93. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): Antibiotic-supplemented PDA (e.g., with chloramphenicol) is often preferred over acid-supplemented PDA for enumerating yeasts and molds in certain foods.
Reason (R): Acidifying the agar can cause sublethal injury to stressed fungal cells and may prematurely hydrolyze the agar, making it too soft.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

94. Which of the following statements correctly highlights a major challenge in the detection of viruses in food matrices?
(A) Viruses multiply vigorously in food during transit, masking the initial contamination levels.
(B) Foodborne viruses are structurally extremely large and easily visible under standard light microscopy.
(C) Viruses require living host cells to replicate, preventing growth in standard broths.
(D) Viruses possess thick peptidoglycan walls that resist all standard DNA extraction protocols.

95. Which of the following statements incorrectly describes foodborne protozoan parasites?
(A) They are single-celled eukaryotic organisms.
(B) They actively replicate and increase their numbers on the surface of raw produce during cold storage.
(C) They form environmentally resilient cysts or oocysts to survive outside the host.
(D) They typically have a very low infectious dose, sometimes requiring only a few cysts to cause disease.

96. Match the detection technique in List I with its primary target pathogen in List II:
List I: (Detection Technique)
P. Potato Dextrose Agar plating
Q. Enzyme-Linked Immunosorbent Assay (ELISA)
R. Reverse Transcription PCR (RT-PCR)
S. Immunomagnetic Separation (IMS) followed by Microscopy
List II: (Target Pathogen)
I. Norovirus RNA
II. Cryptosporidium oocysts
III. Fungal spores and yeasts
IV. Viral or bacterial antigens
(A) P-III, Q-IV, R-I, S-II
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-I, R-IV, S-II
(D) P-IV, Q-III, R-II, S-I

97. Which of the following pairs correctly links a foodborne protozoan to its common transmission route or implicated food vehicle?
(A) Toxoplasma gondii – Undercooked meat and contact with cat feces
(B) Giardia lamblia – Deep-sea marine fish
(C) Cyclospora cayetanensis – Commercially canned low-acid foods
(D) Entamoeba histolytica – Pasteurized ultra-high temperature (UHT) milk

98. Which of the following pairs incorrectly correlates a microorganism with the standard culture-dependent method used for its direct detection in food?
(A) Aspergillus flavus – DRBC Agar
(B) Saccharomyces cerevisiae – Acidified Potato Dextrose Agar
(C) Hepatitis A virus – Buffered Peptone Water

Downloaded from www.pdf.tube

enrichment
(D) Zygosaccharomyces bailii – Malt Extract Agar

99. Consider the following steps in the typical extraction and detection of viruses from complex food matrices (e.g., oysters or berries):
1. Elution of viral particles from the food surface using a specialized buffer.
2. Concentration of the eluted viral particles using techniques like PEG precipitation or ultracentrifugation.
3. Extraction and purification of viral nucleic acids (RNA/DNA).
4. Direct enumeration of viral particles by observing turbidity in a nutrient broth.

Which of the statements given above are correct?
(A) 1, 2 and 3
(B) 1, 3 and 4
(C) 2, 3 and 4
(D) 1 and 2

100. Which of the following is NOT a characteristic of most human enteric viruses transmitted via food?
(A) They are generally highly resistant to acidic environments (low pH).
(B) They are primarily transmitted via the fecal-oral route.
(C) They do not cause the sensory spoilage (off-odors, discoloration) of the contaminated food.
(D) They produce enterotoxins in food prior to ingestion.

101. Direction: Read the statements given below and select the correct option.
Statement I: Direct microscopic observation is frequently used as a definitive, standalone method for the routine identification of specific foodborne viruses.
Statement II: Molecular methods such as PCR and RT-qPCR are the gold standards for detecting foodborne viruses due to their high sensitivity and specificity.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

102. Arrange the following steps in the correct operational sequence for detecting Norovirus in fresh raspberries using molecular methods:
1. Reverse transcription of extracted viral RNA into complementary DNA (cDNA)
2. Elution and concentration of viral particles from the raspberry surface
3. Amplification of the target cDNA sequence using quantitative PCR
4. Extraction of viral RNA from the concentrated particles

(A) 2, 4, 1, 3
(B) 4, 2, 1, 3
(C) 2, 1, 4, 3
(D) 1, 2, 4, 3

103. An outbreak of prolonged, watery diarrhea is traced to imported fresh basil. Microbiological analysis rules out bacterial and viral causes. Wet mount microscopy with modified acid-fast staining of the basil washings reveals spherical oocysts measuring 8-10 micrometers. What is the most likely etiological agent?
(A) Listeria monocytogenes
(B) Hepatitis E virus
(C) Saccharomyces cerevisiae
(D) Cyclospora cayetanensis

NODIA

104. What is the cause-and-effect relationship associated with the extremely low infectious dose (often < 100 cysts) of protozoan parasites like Cryptosporidium?
(A) Minor filtration breakdowns can lead to large-scale outbreaks.
(B) They require massive, visible contamination of water sources to pose a public health threat.
(C) They are rapidly destroyed by the competitive action of native aquatic bacteria.
(D) They provoke an immediate allergic reaction in the mouth upon ingestion.

105. A laboratory detects Norovirus RNA in a batch of frozen strawberries using RT-qPCR. A food business operator argues that the freezing process destroyed the virus and the RNA is from "dead" particles. Applying your knowledge of molecular methods, how is this situation best interpreted?
(A) RT-qPCR differentiates flawlessly between infective and non-infective viral particles based on RNA length.
(B) The presence of viral RNA does not definitively confirm infectivity.

(C) Freezing completely denatures all viral RNA, meaning the positive result must be a false positive.
(D) Viruses cannot survive freezing temperatures, so the product is guaranteed safe regardless of the PCR result.

106. How are culture-independent methods broadly defined in the context of food microbiology?
(A) Analytical techniques that strictly require the initial growth of microorganisms on solid agar media prior to testing.
(B) Methods that analyze pathogens directly from the food sample without prior cultivation.
(C) Subjective sensory evaluations performed by trained panels to detect microbial off-odors.
(D) Physical methods exclusively used to measure the water activity and pH of a food product.

107. Which specific genetic marker is most universally targeted for profiling complex bacterial communities in food ecosystems using culture-independent methods?
(A) 16S rRNA gene
(B) Mitochondrial DNA (mtDNA)
(C) Chloroplast DNA
(D) Hemolysin gene

108. The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): In Denaturing Gradient Gel Electrophoresis (DGGE), DNA fragments of the same length but different sequences can be separated.
Reason (R): DGGE separates PCR-amplified DNA based on the differing melting behaviors of the sequences as they migrate through a gradient of chemical denaturants.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

109. Which of the following statements correctly identifies a primary advantage of culture-independent profiling methods (like DGGE/TGGE) over traditional culture-dependent techniques?
(A) They allow for the isolation of live, pure cultures for antibiotic testing.
(B) They are completely immune to biases introduced during DNA extraction and PCR amplification.
(C) They require significantly less sophisticated equipment and technical expertise to perform.
(D) They bypass the plate count anomaly and can detect VBNC organisms.

110. Which of the following statements incorrectly characterizes Temperature Gradient Gel Electrophoresis (TGGE)?
(A) It relies on a linear temperature gradient rather than a chemical gradient to denature DNA.
(B) It separates DNA fragments based on their specific sequence-dependent melting behavior.
(C) It requires microbial cultivation in enrichment broth prior to analysis.
(D) It is a powerful tool for monitoring microbial population dynamics during food fermentations.

111. Match the molecular community profiling technique in List I with its primary mechanism of separation in List II:
List I: (Molecular Community Profiling Technique)
P. DGGE
Q. TGGE
R. SSCP (Single-Strand Conformation Polymorphism)
S. T-RFLP (Terminal Restriction Fragment Length Polymorphism)
List II: (Mechanism of Separation)
I. Separation of single-stranded DNA based on 3D folded secondary structure
II. Separation of double-stranded DNA using a gradient of urea and formamide
III. Separation of fluorescently labeled DNA fragments based on restriction enzyme cut sites
IV. Separation of double-stranded DNA using an increasing thermal gradient
(A) P-II, Q-IV, R-I, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-II, R-I, S-III
(D) P-II, Q-III, R-IV, S-I

Click Here to Buy book on Amazon

112. Which of the following pairs correctly relates a profiling method with its critical functional requirement?
(A) SSCP – Requires the use of highly concentrated restriction endonucleases.
(B) TGGE – Requires a dense gradient of cesium chloride.
(C) Culture-independent sequencing – Requires the visual counting of colony forming units.
(D) DGGE – Requires a GC-clamp attached to one of the PCR primers.

113. Which of the following pairs incorrectly matches a molecular technique with its typical application in food microbiology?
(A) Metagenomics – Purifying individual bacterial toxins from a food matrix
(B) DGGE – Tracking microbial shifts during sourdough fermentation
(C) SSCP – Analyzing the diversity of the intestinal microflora in food animals
(D) TGGE – Differentiating closely related strains based on 16S rRNA variation

114. Consider the following limitations of PCR-based culture-independent community profiling (like DGGE/SSCP):
1. Incomplete lysis of certain tough microbial cells during DNA extraction can skew the community representation.
2. PCR amplification can introduce chimeric sequences that falsely represent non-existent organisms.
3. DNA from dead or non-viable cells is easily amplified, potentially leading to false-positive viability assessments.
4. They provide direct, real-time measurements of the biochemical enzymatic activity of the community.

Which of the statements given above are correct?
(A) 1, 2 and 3
(B) 1, 3 and 4
(C) 2, 3 and 4
(D) 1 and 2

115. Which of the following techniques is NOT typically utilized as a molecular fingerprinting tool for assessing entire microbial community diversity?
(A) High-Performance Liquid Chromatography (HPLC)
(B) Denaturing Gradient Gel Electrophoresis (DGGE)
(C) Single-Strand Conformation Polymorphism (SSCP)
(D) Terminal Restriction Fragment Length Polymorphism (T-RFLP)

116. Direction: Read the statements given below and select the correct option.
Statement I: The "Viable But Non-Culturable" (VBNC) state represents a survival mechanism where bacteria lose their metabolic activity completely and permanently.
Statement II: Culture-independent methods detect DNA, making them capable of identifying the presence of VBNC pathogens that would be missed by standard plating.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

117. What is the most appropriate next step for an analyst who observes a single, intense band on a DGGE gel and wishes to definitively identify the bacterial species it represents?
(A) Discard the gel and repeat the extraction using a different food sample.
(B) Excise the band, re-amplify the DNA, and sequence it.
(C) Correlate the band's position directly with a standard colony count curve.
(D) Treat the gel with extreme heat to visualize the remaining proteins.

118. A researcher is studying the succession of lactic acid bacteria during the maturation of traditional raw milk cheese. They want to visualize how the dominance of different species changes over a 6-month period without culturing. Which method is most applicable for this community profiling?
(A) Standard aerobic plate counting on Plate Count Agar
(B) Enzyme-Linked Immunosorbent Assay (ELISA) for staphylococcal enterotoxin
(C) Temporal profiling using DGGE
(D) Direct microscopic somatic cell counting

119. What is the direct effect of omitting the GC-clamp (a 40-bp GC-rich sequence) from the

NODIA

forward primer when preparing amplicons for DGGE analysis?
(A) The DNA fragments will separate solely based on size, acting like a standard agarose gel.
(B) The DNA polymerase will instantly degrade the template DNA.
(C) The resulting bands will inherently glow without the need for fluorescent staining.
(D) The fragments will completely dissociate into single strands, causing loss of resolution.

120. A small food safety laboratory lacks the specialized equipment required to create and maintain precise chemical or thermal gradients in electrophoresis gels, but they possess standard vertical gel electrophoresis units. Which culture-independent profiling method could they most easily apply based on their equipment constraint?
(A) Single-Strand Conformation Polymorphism (SSCP)
(B) Denaturing Gradient Gel Electrophoresis (DGGE)
(C) Temperature Gradient Gel Electrophoresis (TGGE)
(D) Next-Generation Sequencing (NGS)

121. How is metagenomics best defined in the context of food microbiology?
(A) The precise measurement of the total metabolic heat generated by a food product.
(B) Direct sequencing of collective genomic DNA from a food community.
(C) The process of selectively culturing only the pathogenic fraction of a microbiome.
(D) The morphological classification of fungal spores using scanning electron microscopy.

122. In the MALDI-TOF MS technique used for rapid microbial identification, which specific biological macromolecules are primarily ionized and analyzed to generate the characteristic spectral fingerprint?
(A) Extracellular capsular polysaccharides
(B) Ribosomal proteins
(C) Membrane phospholipids
(D) Genomic DNA sequences

123. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): Digital PCR (dPCR) allows for the absolute quantification of target pathogen DNA without the need for a standard curve.
Reason (R): Digital PCR partitions the sample into thousands of individual micro-reactions, and absolute quantification is achieved by applying Poisson statistics to the count of positive and negative partitions.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

124. Which of the following statements correctly highlights a key difference between quantitative PCR (qPCR) and conventional PCR?
(A) qPCR strictly requires the use of RNA templates, whereas conventional PCR only uses DNA.
(B) qPCR utilizes agarose gels for final detection, whereas conventional PCR utilizes fluorescent probes.
(C) qPCR measures DNA amplification in real-time, whereas conventional PCR is an end-point assay.
(D) qPCR has a significantly lower sensitivity and higher limit of detection compared to conventional PCR.

125. Which of the following statements incorrectly characterizes Next-Generation Sequencing (NGS) applications in food microbiology?
(A) NGS can perform Whole Genome Sequencing (WGS) to trace the exact source of a foodborne outbreak strain.
(B) 16S amplicon sequencing using NGS provides a deep profile of the bacterial community structure.
(C) NGS produces massive amounts of data requiring significant bioinformatic analysis to interpret.
(D) NGS provides instantaneous, point-of-care results within minutes directly on the factory floor.

126. Match the advanced analytical platform in List I with its underlying operational technology in List II:
List I: (Advanced Analytical Platform)
P. qPCR
Q. MALDI-TOF MS
R. Next-Generation Sequencing (NGS)

Downloaded from www.pdf.tube

units to be examined from a lot.
(B) 'c' is the maximum acceptable number of sample units allowed to yield marginal results between 'm' and 'M'.
(C) 'm' is the limit above which product is deemed hazardous and rejected.
(D) 'M' is the maximum limit; any sample exceeding 'M' results in immediate rejection of the entire lot.

141. Match the parameter of a standardized 3-class microbiological sampling plan in List I with its correct definition in List II:
List I: (Sampling Plan Parameter)
P. n
Q. c
R. m
S. M
List II: (Definition)
I. The microbiological limit separating good quality from marginally acceptable quality.
II. The maximum number of sample units allowed to have a count between m and M.
III. The number of sample units to be randomly selected and tested from a batch.
IV. The absolute upper limit; counts exceeding this are completely unacceptable.
(A) P-III, Q-II, R-I, S-IV
(B) P-I, Q-III, R-IV, S-II
(C) P-III, Q-IV, R-II, S-I
(D) P-II, Q-I, R-III, S-IV

142. Which of the following pairs correctly identifies the format of an Enzyme-Linked Immunosorbent Assay (ELISA) with its mechanism?
(A) Direct ELISA – Uses a primary antibody strictly conjugated to a radioactive isotope
(B) Competitive ELISA – The target antigen multiplies the signal economically
(C) Sandwich ELISA – Antigen is captured between two specific antibodies
(D) Indirect ELISA – The enzyme substrate binds directly to the plastic well

143. Which of the following pairs incorrectly correlates a rapid testing method with its primary diagnostic target?
(A) Lateral flow strip – Pathogen-specific antigens or toxins
(B) Impedance microbiology – Rapid detection of viral capsids
(C) ATP bioluminescence – General organic residue and cellular ATP
(D) Real-time PCR – Specific DNA or RNA sequences

144. Consider a batch of food tested under a 3-class sampling plan where n = 5, c = 2, m = 10^3 CFU/g, and M = 10^5 CFU/g.
Read the following scenarios:
1. The results are: 10^2, 10^2, 10^2, 10^2, 10^2
2. The results are: 10^4, 10^4, 10^4, 10^2, 10^2
3. The results are: 10^4, 10^2, 10^2, 10^2, 10^2
4. The results are: 10^6, 10^2, 10^2, 10^2, 10^2
Which of the above scenarios result in the rejection of the batch?
(A) 2 and 4
(B) 1 and 3
(C) 3 and 4
(D) 1, 2 and 4

145. Which of the following is NOT a functional component of a standard biosensor utilized in food microbiology?
(A) High-efficiency particulate air (HEPA) filter
(B) Bioreceptor (e.g., antibody, aptamer, enzyme)
(C) Transducer (e.g., optical, electrochemical)
(D) Signal processor/Display

146. Direction: Read the statements given below and select the correct option.
Statement I: CODEX guidelines suggest that microbiological criteria should be established based on formal risk assessment principles and epidemiological evidence.
Statement II: A 2-class sampling plan strictly uses the parameters 'n', 'c', 'm', and 'M' to evaluate marginal food quality.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

147. A sanitation worker swabbing a stainless-steel meat slicer immediately after cleaning and sanitizing receives an ATP bioluminescence reading of 4,500 Relative Light Units (RLU), where the pass threshold is < 150 RLU. What is the most appropriate and immediate corrective action?
(A) Immediately reclean, resanitize, and re-swab

NODIA

food processing facilities. Public health officials utilize Whole Genome Sequencing (WGS). The sequences from clinical isolates match the sequences of isolates from Facility A with zero single nucleotide polymorphism (SNP) differences, but differ from Facility B by over 500 SNPs. What is the most solid conclusion?
(A) Facility B is the definite source of the current outbreak.
(B) Facility A is strongly implicated as the outbreak source.
(C) Neither facility is involved; it is a spontaneous mutation event.
(D) WGS cannot differentiate strains at the facility level.

134. Complex food matrices, such as those rich in fats, humic acids, or complex carbohydrates, frequently cause which specific problem during PCR-based pathogen detection?
(A) They cause the spontaneous luminescence of the sample, blinding the sensor.
(B) They accelerate the PCR reaction, causing it to finish in seconds and yielding false-positive results.
(C) They act as PCR inhibitors, binding to polymerase or DNA and causing false negatives.
(D) They induce immediate crystallization of the extracted DNA.

135. A quality control lab wants to use qPCR to quantify Salmonella in a pasteurized egg product. However, they are concerned that qPCR will amplify DNA from Salmonella cells that were killed during pasteurization. What pre-treatment concept application can they use to exclusively amplify DNA from viable cells?
(A) Treating the sample with a high dose of ultraviolet light before DNA extraction.
(B) Incubating the sample at 4°C for 5 days prior to running the qPCR.
(C) Adding a high concentration of sodium chloride to the PCR master mix.
(D) Treating the sample with PMA to inhibit dead-cell DNA amplification.

136. What is the fundamental definition of a biosensor in the context of rapid food microbiology?
(A) A device combining a bioreceptor and a transducer to produce a measurable signal.
(B) A purely mathematical model used to predict microbial growth under varying temperatures.
(C) A large-scale industrial centrifuge used to physically separate bacteria from milk.
(D) A standard agar plate infused with a universal fluorescent dye.

137. Which specific enzyme-substrate system is utilized in standard ATP bioluminescence hygiene monitoring assays?
(A) Taq polymerase and dNTPs
(B) Luciferase and Luciferin
(C) Beta-galactosidase and ONPG
(D) Catalase and Hydrogen Peroxide

138. Direction: The following question consists of two statements, one labeled as Assertion (A) and the other as Reason (R). Read both statements and select the correct option.
Assertion (A): ATP bioluminescence swabbing is an excellent tool for real-time verification of cleaning and sanitation efficacy on food contact surfaces.
Reason (R): The ATP bioluminescence assay specifically and exclusively detects the presence of pathogenic bacterial species like Listeria and Salmonella.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

139. Which of the following statements regarding the operational principle of a Lateral Flow Assay (LFA) used for rapid pathogen detection is correct?
(A) It involves capillary flow of a sample across a membrane with antibody-coupled reporter particles.
(B) It relies on the mass-to-charge ratio of pathogen proteins separating in a vacuum.
(C) It requires the continuous measurement of fluorescent DNA amplification over 40 thermal cycles.
(D) It works by measuring the change in electrical impedance as bacteria multiply in a liquid broth over 24 hours.

140. Which of the following statements incorrectly interprets the FSSAI/CODEX microbiological criteria for a 3-class sampling plan?
(A) 'n' represents the total number of sample

Click Here to Buy book on Amazon

S. Digital PCR

List II: (Underlying Operational Technology)

I. Employs laser ionization and time-of-flight mass analysis of proteins

II. Monitors DNA amplification continuously using fluorescent dyes or probes

III. Partitions a sample into thousands of nanoliter droplets for individual amplification

IV. Generates millions of short DNA sequence reads simultaneously in a flow cell

(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-I, S-II
(D) P-II, Q-IV, R-I, S-III

127. Which of the following pairs correctly relates a component of the MALDI-TOF MS process with its function?

(A) TOF Analyzer – Amplifies the microbial DNA
(B) Chemical Matrix – Assists laser-driven analyte ionization
(C) Vacuum Chamber – Promotes the rapid growth of bacterial colonies
(D) Laser pulse – Cleaves the bacterial cell wall using enzymatic action

128. Which of the following pairs incorrectly matches a technique with its quantification characteristic?

(A) Standard qPCR – Relative or absolute quantification relying on a standard curve
(B) Digital PCR – Absolute quantification without a standard curve
(C) Total Plate Count – Estimation of viable, culturable cells
(D) Conventional PCR – Highly precise real-time absolute quantification

129. Consider the following applications of Metagenomics in food safety:

1. Identifying unculturable or novel spoilage organisms responsible for food defects.
2. Detecting the presence of antimicrobial resistance (AMR) genes across the entire food microbiome.
3. Completely eliminating the need for any form of sample preparation or DNA extraction.
4. Characterizing the complex microbial ecology of traditional fermented foods.

Which of the statements given above are correct?

(A) 1, 2 and 4
(B) 1, 3 and 4
(C) 2, 3 and 4
(D) 1 and 2

130. Which of the following is NOT a step involved in the standard protocol for microbial identification using MALDI-TOF MS?

(A) Selecting an isolated colony from an agar plate.
(B) Smearing the colony onto a metal target plate and overlaying it with a chemical matrix.
(C) Subjecting the sample to a highly concentrated gradient of urea to denature the DNA.
(D) Comparing the generated mass spectrum against a comprehensive reference database.

131. Direction: Read the statements given below and select the correct option.

Statement I: In real-time quantitative PCR (qPCR), a lower Cycle Threshold (Ct) value indicates a higher initial concentration of target DNA in the sample.

Statement II: The Ct value is the cycle number at which the fluorescence generated by amplification crosses a defined background threshold.

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

132. Arrange the following steps in the generalized workflow for identifying a foodborne outbreak strain using Whole Genome Sequencing (WGS):

1. Bioinformatic assembly of the short reads and comparison against a global pathogen database (e.g., GenomeTrakr)
2. Extraction of high-quality genomic DNA from the isolated pure culture
3. Fragmentation of DNA and attachment of sequencing adapters (Library preparation)
4. Loading the library onto the NGS sequencer to generate millions of short sequence reads

(A) 2, 3, 4, 1
(B) 3, 2, 4, 1
(C) 2, 4, 3, 1
(D) 3, 4, 2, 1

133. During a widespread outbreak of Salmonella, epidemiological data links cases to two separate

NODIA

the slicer before production.
(B) Quarantine all meat sliced the previous day and initiate a massive product recall.
(C) Ignore the result as ATP tests are prone to random false positives.
(D) Send the swab to a lab for whole-genome sequencing to identify the specific pathogen.

148. A food safety officer applies FSSAI microbiological guidelines to evaluate a batch of ready-to-eat dairy desserts. The sampling plan for Staphylococcus aureus is n = 5, c = 1, m = 10 CFU/g, M = 100 CFU/g. The test results for the 5 samples are: 5, < 10, 50, < 10, < 10. How should the officer interpret this result?
(A) Reject the batch because one sample exceeded 'm'.
(B) Reject the batch because the average of the 5 samples exceeds the limit.
(C) Accept the batch but mandate a mandatory recall of all previous batches.
(D) Accept the batch because only one sample is between 'm' and 'M'.

149. What is the cause-and-effect relationship of swabbing a food processing surface that retains macroscopic visible food residue (like meat juice) with an ATP bioluminescence swab?
(A) The test will yield a falsely low reading due to quenching of the luciferase enzyme.
(B) The test will yield a very high RLU reading due to somatic ATP in the food residue.
(C) The swabbing reagent will chemically dissolve the meat juice, perfectly separating microbial ATP from food ATP.
(D) The visible food residue will physically block the swab, preventing the enzyme reaction from occurring at all.

150. Regulatory agency is designing a microbiological sampling plan for powdered infant formula targeting a severe hazard, specifically Cronobacter sakazakii. Which of the following sampling plan configurations is the most appropriate conceptual application for this high-risk scenario?
(A) A 3-class plan with n = 5, c = 2 to allow for marginal tolerance.
(B) A 2-class plan with n = 1, c = 1, to minimize laboratory testing costs.
(C) A 2-class plan with n = 60, c = 0, requiring pathogen absence.
(D) A 3-class plan with n = 10, c = 5, m = 100, M = 1000.

www.nodia.in

NODIA

ANSWERS

1. (A) Contamination from the natural environment where food is grown or reared.
Primary food contamination refers to the initial introduction of microorganisms into agricultural raw materials from their natural habitats during growth or rearing. This typically involves environmental sources like soil, water, air, or wild animals that directly contact the crops or livestock before any post-harvest processing or handling occurs at the factory.

2. (C) Bacillus cereus
Spore-forming bacterial species widely inhabit agricultural soils and are frequently transferred to raw crops. These endospores survive environmental stressors, making them common contaminants of agricultural commodities like rice, cereal grains, and root vegetables. Their natural presence in soil ensures constant exposure for crops grown in direct contact with the ground.

3. (A) Both A and R are true and R is the correct explanation of A.
Open water bodies face constant exposure to environmental factors, including precipitation, agricultural land runoff, and direct animal fecal discharge. These elements introduce a highly diverse and fluctuating microbial population. Conversely, deep groundwater undergoes natural filtration through soil layers, which significantly minimizes contamination and ensures a highly stable, low microbial baseline.

4. (D) Air serves strictly as a transport medium and does not support the active multiplication of microorganisms.
Ambient air lacks the necessary moisture, dissolved nutrients, and stable temperature conditions required to sustain active microbial metabolic processes and cellular division. Consequently, suspended dust particles and liquid droplets only transport microorganisms. This physical suspension allows viable cells and spores to disperse across processing environments without active bacterial replication.

5. (B) The microflora on fresh produce strictly reflects pathogens of the seed cultivar.
The microbial community present on the exterior surfaces of freshly harvested raw produce is highly dynamic and diverse. This surface microflora is influenced by the surrounding soil, irrigation water quality, post-harvest handling, and atmospheric deposition. It is not limited to or reflective of pathogens inherent to the genetic seed cultivar.

6. (A) P-III, Q-IV, R-I, S-II
Different environmental reservoirs harbor distinct dominant microorganisms. Spore-forming anaerobes naturally inhabit soil, while halophilic or pathogenic aquatic bacteria reside in water bodies. Micrococci are highly resistant to desiccation, allowing them to persist in air, and enteric bacteria are key indicators of fecal contamination from the intestinal tracts of warm-blooded animals.

7. (D) Fresh eggs – Salmonella Enteritidis
Poultry oviduct infections can lead to the transovarian transmission of pathogenic bacteria into the yolk or albumen before the shell is formed. This vertical transmission route makes poultry products a primary vehicle for these specific enteric pathogens, emphasizing the critical importance of proper cooking and pasteurization of egg-containing food products.

8. (A) Air – Dissolved oxygen concentration
The survival and dissemination of airborne microorganisms are heavily influenced by environmental parameters such as relative humidity, temperature, and solar radiation. Dissolved oxygen is a critical physical parameter for aquatic environments, but it does not represent a variable environmental factor affecting the desiccation or transport of microbes suspended in the atmosphere.

9. (B) 1 and 3
Strong winds and dust storms physically transport robust, desiccation-resistant bacterial spores across vast geographical distances to contaminate crops. Additionally, using agricultural soil amendments such as raw or improperly composted animal manure acts as a direct vector, introducing

Downloaded from www.pdf.tube

dangerous enteric pathogens into the cultivation environment where they can colonize growing food crops.

10. (B) Sorting tables in the packhouse
Primary contamination occurs during the pre-harvest phase in the agricultural field, driven by natural reservoirs like soil, irrigation water, and wild animals. In contrast, surfaces within post-harvest facilities, such as sorting tables, represent secondary sources of contamination, where clean crops are exposed to pathogens during handling, sorting, and packaging processes.

11. (D) Statement I is incorrect but Statement II is correct.
Soil microbial populations are highly dynamic, changing constantly with moisture, temperature, and cultivation practices. Certain environmental pathogens are highly resilient and can persist in soil for many months. This extended survival establishes a continuous reservoir that can repeatedly contaminate crops grown in that field long after the initial introduction of the pathogen.

12. (A) 3, 4, 1, 2
The contamination sequence begins when untreated soil amendments introduce pathogens into the agricultural field. These organisms then survive on plant surfaces during active crop growth. During harvest, contaminated soil physically clings to the produce. Finally, if the food is consumed raw or undercooked, the consumer ingests these viable pathogens, causing potential illness.

13. (D) Runoff of cattle manure into the farm's irrigation water source
Heavy rainfall or agricultural activities can cause fecal runoff from nearby livestock operations to enter surface water bodies used for crop irrigation. When this contaminated water is applied to leafy greens, enteric pathogens adhere to the foliage. This pathway represents a major mechanism for the widespread environmental transmission of agricultural pathogens.

14. (C) Significant increase in the load of human enteric pathogens in the soil
Applying untreated municipal sewage sludge directly to agricultural land introduces high concentrations of human pathogens, including enteric bacteria, viruses, and parasites. These microorganisms persist in the soil matrix and can easily transfer to the surfaces of crops, posing a direct and severe microbiological safety hazard to consumers of the harvested food.

15. (B) Utilizing plastic mulch and subsurface drip irrigation
Subsurface drip irrigation delivers water directly to the plant roots below the soil surface, preventing water from splashing onto the fruit. Combined with physical plastic mulch barriers, this technique prevents direct contact between the soil microflora and the ripening strawberries, significantly lowering the risk of transferring pathogens from the ground to the crop.

16. (D) Contamination introduced during the processing or packaging of the food product.
Secondary contamination refers to the introduction of microorganisms into food products after harvest or slaughter. This occurs during downstream operations such as processing, cutting, slicing, handling, and packaging. The primary sources of these microbes include contaminated equipment surfaces, processing water, factory personnel, and the immediate manufacturing facility environment.

NODIA

17. (A) Extracellular polymeric substance (EPS) matrix
Certain bacterial species secrete a complex mixture of polysaccharides, proteins, and nucleic acids that forms a protective barrier. This self-produced extracellular matrix facilitates irreversible attachment to stainless steel and other food-contact surfaces. The resulting biofilm physically shields the embedded microorganisms from chemical sanitizers and mechanical scrubbing during cleaning operations.

18. (A) Both A and R are true and R is the correct explanation of A.
Water is used extensively throughout food processing facilities for washing, formulation, and sanitation. If the water supply contains pathogens, it can rapidly distribute these microorganisms across food-contact surfaces, equipment, and final products. Therefore, maintaining strict potability standards is essential to prevent widespread cross-contamination and protect public health.

19. (A) Static electricity on plastic packaging films can attract airborne microbial contaminants.
High-speed handling of plastic packaging materials often generates static electrical charges on the film

59. (A) It prevents storage mold proliferation and mycotoxin production.
Drying harvested grains to a water activity below 0.65 restricts the metabolic activity and germination of fungal spores. This control measure stops the proliferation of spoilage molds and prevents the synthesis of toxic secondary metabolites like mycotoxins. It is a critical post-harvest preservation technique used to maintain grain safety and quality.

60. (C) Ensuring the wash water temperature is at least 10°F warmer than the tomatoes.
If wash water is colder than the internal temperature of a tomato, the temperature difference causes the air inside the fruit to contract. This contraction creates a partial vacuum that pulls water and surface pathogens through the stem scar into the internal tissues. Keeping the water warmer than the fruit prevents this internalization process.

61. (D) An estimate of live, culturable heterotrophic microbes under specific incubation conditions.
The Total Viable Count provides an estimate of the population of live, heterotrophic microorganisms in a food sample that can multiply and form visible colonies on a nutrient agar medium. This count is dependent on the specific incubation temperature, time, and atmosphere used during testing, and it does not detect unculturable organisms.

62. (C) Pseudomonas
Psychrotrophic bacteria can multiply at refrigeration temperatures, with optimal growth occurring at mesophilic ranges. Gram-negative rod-shaped bacteria belonging to this genus dominate the microflora of raw milk stored under refrigeration. They produce extracellular enzymes that degrade milk proteins and lipids, causing spoilage defects like off-flavors, bitterness, and gelation.

63. (A) Both A and R are true and R is the correct explanation of A.
Pasteurization targets vegetative pathogens but does not destroy bacterial endospores or heat-stable enzymes. Psychrotrophic bacteria present in raw milk can produce extracellular lipases and proteases before heat treatment. These enzymes survive pasteurization and continue to break down milk proteins and fats during refrigerated storage, causing off-flavors and physical defects in the milk.

64. (D) The deep muscle tissue of a healthy, unstressed animal is generally sterile prior to slaughter.
In healthy, unstressed livestock, the internal muscle tissues are protected by the immune system and are free of microorganisms before slaughter. Contamination of meat occurs post-mortem during skinning, evisceration, and butchering, when bacteria from the animal's hide, intestinal tract, and the processing environment are transferred to the freshly exposed meat surfaces.

65. (A) TPC provides a direct and immediate correlation with the presence of severe foodborne pathogens like Salmonella.
Plate counts measure the general population of aerobic mesophilic bacteria but do not indicate the presence of specific pathogens. Pathogens like Salmonella can cause illness even when present in very low numbers that do not significantly affect the total plate count. Specific selective enrichment and detection protocols are required to identify these pathogens.

66. (A) P-III, Q-IV, R-I, S-II
Under aerobic refrigeration, psychrotrophic bacteria form a visible surface slime on meat. In vacuum packaging, lactic acid bacteria dominate, causing souring and greening defects. Anaerobic spore-formers cause deep tissue putrefaction near the bone, while specialized molds grow on the surface of aged beef, forming a characteristic fuzzy growth known as whiskers.

67. (D) Both (A) and (C)
Spore-forming bacteria produce extracellular rennet-like enzymes that cause the sweet curdling of milk without significant acid production. Additionally, specific psychrotrophic bacteria can produce water-soluble pigments, such as the blue pigment pyoverdine, which causes a distinct blue discoloration defect on the surfaces of cheeses and other refrigerated dairy products.

68. (D) Yeast and Mold count – Evaluated using Plate Count Agar
Plate Count Agar is formulated to support a wide range of bacteria and is not suitable for selective fungal enumeration. Enumerating yeasts and molds requires specialized, selective media with a low pH or added antibiotics, such as Potato Dextrose Agar or Dichloran Rose Bengal Chloramphenicol Agar, which inhibit bacterial growth.

Click Here to Buy book on Amazon

29. (D) It causes rapid depletion of free available chlorine.
Organic matter like soil and vegetable juices reacts rapidly with free available chlorine, neutralizing its disinfectant properties. This reaction reduces the concentration of active sanitizer in the water, allowing surviving pathogens to persist and cross-contaminate clean produce. Continuous monitoring and water management are required to maintain sanitizing efficacy.

30. (C) Minimization of niches for organic residue and biofilm formation
Sanitary design principles require smooth, non-porous surfaces and rounded internal corners to prevent the accumulation of food debris and moisture. Eliminating these physical niches makes cleaning procedures more effective, preventing bacteria from colonizing hard-to-reach areas and forming resilient biofilms that could continuously shed pathogens into the food stream.

31. (B) An enclosed space where particulate and microbial levels are controlled.
A clean room is a specialized, environmentally controlled space designed to limit particulate and microbial contamination. This is achieved by regulating parameters such as air filtration, temperature, humidity, and airflow patterns. These rooms are utilized in high-risk food processing areas, such as aseptic filling, to protect sensitive products.

32. (D) HEPA filters
High-Efficiency Particulate Air filters are the industry standard for removing airborne microorganisms from the air supply of high-risk food processing zones. These filters physically trap microfine particles, including bacterial cells, fungal spores, and viral aerosols, ensuring that the air entering clean rooms is free of microbiological hazards that could contaminate products.

33. (A) Both A and R are true and R is the correct explanation of A.
Maintaining higher air pressure inside a clean room relative to surrounding areas creates a continuous outward airflow. When doors or hatches are opened, this positive pressure gradient prevents lower-quality air from entering the clean zone. This physical barrier ensures that airborne dust and microorganisms from adjacent areas do not contaminate the product.

34. (C) Impaction collects on solid agar, whereas impingement collects into a liquid.
Impaction and impingement are active air sampling methods that differ in their collection media. Impaction accelerates airborne particles through a nozzle directly onto a solid agar surface for subsequent incubation. Impingement directs the airflow into a liquid collection medium, which washes the particles out of the air stream for quantitative analysis.

35. (A) They provide a highly quantitative measure of microbes per cubic meter.
Settle plates are a passive air monitoring method that relies on gravity to deposit particles onto agar surfaces. Because they do not draw a controlled volume of air, they cannot provide a precise quantitative measurement of microbes per cubic meter. They also tend to underestimate smaller, lighter particles that remain suspended in air.

36. (A) P-IV, Q-I, R-III, S-II
Passive settle plates rely on gravity for particles to land on agar, while slit samplers actively draw air through a narrow opening onto rotating agar. Liquid impingers capture suspended microbes by accelerating air into a broth. Finally, membrane filtration physically traps airborne particles within a porous membrane matrix as air passes through.

NODIA

37. (B) UVGI – Damages microbial DNA to prevent replication
Ultraviolet Germicidal Irradiation uses short-wavelength ultraviolet light to target the nucleic acids of microorganisms. This radiation induces thymine dimers in the DNA, disrupting replication and rendering pathogens non-viable. UVGI is commonly integrated into air ducts or clean room ceilings to continuously disinfect the air and reduce overall microbial loads.

38. (C) ISO Class 8 – More stringent than ISO Class 5 for airborne particles
Clean room classifications under ISO standards are structured numerically, where lower class numbers indicate lower permissible concentrations of airborne particulates. Therefore, an ISO Class 5 clean room is significantly cleaner and more stringent than an ISO Class 8 room, which allows for higher particle counts and is typically used for less critical operations.

79. (B) The pour plate method can subject heat-sensitive microbes to thermal shock.
In the pour plate method, the sample is mixed directly with molten agar that has been cooled to approximately 45°C. This brief exposure to elevated temperatures can cause sublethal injury or death to heat-sensitive microorganisms, reducing recovery. The spread plate method avoids this thermal stress by inoculating the sample directly onto pre-solidified agar.

80. (D) It is exceptionally well-suited for highly viscous foods like peanut butter or thick gravies.
Membrane filtration requires the liquid sample to pass easily through a microfine membrane filter. Viscous, fatty, or highly turbid food products will quickly clog the filter pores, preventing the passage of the required volume and trapping food particles that interfere with microbial enumeration. Consequently, this technique is limited to clear, low-viscosity liquids.

81. (A) P-IV, Q-II, R-I, S-III
Specialized media utilize different selective and differential agents to isolate target organisms. Tellurite and egg yolk select for coagulase-positive staphylococci, while high bile and thiosulfate select for vibrios. Acidic media with chloramphenicol isolate yeasts and molds, and sorbitol-containing MacConkey agar is used to differentiate enteric pathogen strains that do not ferment sorbitol.

82. (C) Crystal violet – Inhibits the growth of Gram-positive bacteria
Crystal violet is a selective dye added to culture media to inhibit the growth of Gram-positive bacteria. This inhibition allows for the selective isolation and subsequent enumeration of Gram-negative organisms, such as coliforms and other enterics, from food samples, without interference from the dominant Gram-positive background flora.

83. (A) Bromothymol blue – PDA
Potato Dextrose Agar is a simple, non-differential medium used for cultivating yeasts and molds, and it does not contain bromothymol blue or other pH indicators. In contrast, MacConkey Agar uses neutral red, Mannitol Salt Agar uses phenol red, and EMB Agar uses eosin and methylene blue to differentiate target organisms based on fermentation.

84. (A) 1, 2 and 4
The pour plate method accommodates larger sample volumes than spread plating, and subsurface colonies typically grow as small, lens-shaped structures due to physical agar compression. To prevent microbial death, the molten agar must be cooled to 45°C before pouring. However, this method is unsuitable for observing fungal sporulation patterns.

85. (B) They allow for the isolation of pure cultures for downstream antimicrobial susceptibility testing.
The ability to isolate live, pure cultures for downstream characterization is a key advantage of traditional culture-dependent methods, rather than a limitation. The primary limitations of these methods include long incubation times, their inability to detect viable but non-culturable cells, and the destructive nature of sample preparation.

86. (A) Both Statement I and Statement II are correct.
Microorganisms in processed foods often suffer sublethal injury from heating, chilling, or acid exposure. These damaged cells cannot grow on selective media due to their increased sensitivity to selective agents. Pre-enrichment in a non-selective, nutrient-rich broth allows these injured cells to repair their cell membranes and metabolic pathways before selective isolation.

87. (D) Spread plate method
The spread plate method is ideal for enumerating strictly aerobic, heat-sensitive bacteria. Because the sample is inoculated directly onto the surface of pre-solidified agar, the cells are not exposed to the thermal stress of molten agar. Surface growth also ensures maximum oxygen access, supporting the growth of obligate aerobes.

88. (A) Use the 10^{-3} plate because the 10^{-2} plate exceeds the valid counting range.
Standard microbiological guidelines require selecting plates containing between 30 and 300 colonies for enumeration. A plate with 450 colonies exceeds this range, which can lead to undercounting due to colony overcrowding and nutrient competition. Therefore, the analyst should use the plate within the valid range to calculate the final count.

Downloaded from www.pdf.tube

49. (A) The low pH of most fruits primarily favors yeasts and molds.
Most fruits have an acidic pH that inhibits the growth of many common spoilage bacteria. Consequently, the natural microflora of raw fruits is dominated by yeasts and molds, which tolerate low pH conditions. These fungi can utilize the natural sugars present in the fruit, leading to common spoilage defects like rot and fermentation.

50. (C) Lactic acid bacteria are completely absent from the natural microflora of harvested grains.
Lactic acid bacteria are widely distributed in nature and are regularly found as part of the epiphytic microflora of harvested cereal grains. While environmental molds and spore-forming bacteria are often more dominant, lactic acid bacteria are present and can proliferate when moisture levels and anaerobic conditions favor their growth during storage or fermentation.

51. (A) P-II, Q-III, R-IV, S-I
Fresh meat stored aerobically at low temperatures is primarily spoiled by psychrotrophic bacteria. Raw milk naturally contains lactic acid bacteria that cause souring, while the high acidity of citrus fruits favors yeasts and molds. Cereal grains, with their low water activity, are susceptible to storage fungi like Penicillium and Aspergillus species.

52. (D) Vegetables – Bacterial soft rot caused by Erwinia species
Certain bacterial pathogens produce pectolytic enzymes that hydrolyze pectin, the structural component of plant cell walls. This enzymatic breakdown causes the characteristic mushy texture and foul odor of soft rot in fresh vegetables. This represents a major spoilage mechanism for root crops and leafy greens during storage and transport.

53. (B) Wearing a hairnet – Introduction of Bacillus cereus spores
Wearing a clean, approved hairnet is a preventative hygienic measure designed to contain hair and scalp flakes, thereby reducing the risk of contamination. It does not introduce bacterial spores. In contrast, bad practices like coughing, failing to wash hands, or wearing dirty clothing directly introduce pathogenic bacteria, viruses, and environmental molds to food.

54. (A) 1 and 3
Fresh vegetables have a near-neutral pH and high water content, making them highly susceptible to bacterial spoilage. Furthermore, heavy rains can splash soil-borne microorganisms directly onto low-growing crops, significantly increasing their microbial load. Simple washing with plain water is insufficient to remove pathogens that have attached to or colonized the plant tissue.

55. (D) Vibrio cholerae
The natural microflora of harvested grains consists of soil-borne bacteria, yeasts, and field fungi such as Fusarium, Alternaria, and Cladosporium. These organisms are adapted to low-moisture environments. Pathogenic Vibrio species, however, are aquatic bacteria found in marine and brackish water, and they do not occur naturally on dry agricultural cereal crops.

NODIA

56. (C) Statement I is correct but Statement II is incorrect.
Transient flora are acquired from contaminated surfaces and reside loosely on the skin surface, making them easy to remove with soap and water. In contrast, resident flora are normal, non-pathogenic skin microorganisms that help protect against colonization by pathogens. They cannot be completely eradicated, nor do they need to be.

57. (B) When the handler is experiencing acute diarrhea and vomiting
Food handlers showing symptoms of gastrointestinal illness, such as diarrhea or vomiting, shed high concentrations of viral or bacterial pathogens. To prevent the transmission of these agents through food, regulations mandate that these employees be excluded from the facility until they are symptom-free for a specified period, typically forty-eight hours.

58. (B) Heat-stable enterotoxin produced by Staphylococcus aureus
Food handlers carrying enterotoxigenic bacteria on their hands can contaminate cooked, protein-rich foods during preparation. If the food is temperature-abused, these bacteria multiply and produce enterotoxins. Because these toxins are highly heat-stable, they survive subsequent heating. Ingestion of the pre-formed toxin causes rapid-onset symptoms, including severe nausea and vomiting.

surfaces. These electrostatic forces actively attract dust particles and aerosolized microorganisms from the surrounding air. Consequently, the packaging material itself becomes a secondary source of contamination, transferring collected microbes directly onto the food products during filling operations.

20. (D) Chlorination guarantees the complete destruction of all protozoan cysts in municipal water supplies.
While chlorine is highly effective against vegetative bacterial cells, it does not guarantee the destruction of protozoan cysts. These parasite stages possess thick, chemically resistant outer walls that survive standard municipal chlorination levels. Preventing waterborne protozoan transmission requires physical filtration methods, such as membrane filtration or ultraviolet disinfection, alongside chemical treatments.

21. (A) P-II, Q-IV, R-III, S-I
Food handlers carry pathogens on skin and nasal passages, while conveyor belts with micro-scratches harbor resilient biofilms. Plastic packaging materials generate static charges that attract airborne dust and microbes. Additionally, cooling ice made from unchlorinated or improperly treated water can harbor and transfer viable pathogens directly to perishable foods.

22. (C) Escherichia coli – Reliable indicator of recent fecal pollution
Certain enteric bacteria reside primarily in the intestinal tracts of warm-blooded animals and do not multiply well in environmental water. Detecting these organisms in water samples serves as a highly specific and reliable indicator of recent fecal contamination. This indicates that other enteric pathogens may also be present in the water supply.

23. (D) Chiller water – Airborne aerosolization of dry spores
Chiller water causes contamination through direct immersion or splashing of liquid, which physically transfers microbial cells between carcasses. It is not associated with the dry aerosolization of bacterial spores, which typically requires low-humidity air currents and physical disturbance of dry powdery residues rather than a wet, refrigerated liquid environment.

24. (A) 1 and 3
Biofilms form a protective extracellular matrix that shields bacteria from chemical sanitizers. Once the biofilm matures, it releases planktonic cells back into the flow of food or water, causing continuous downstream contamination. While surface finish affects initial adhesion, even smooth stainless steel can develop biofilms if sanitization is inadequate.

25. (B) Water used in closed-loop refrigeration cooling towers
Water that does not come into direct or indirect contact with food products, such as that used in closed-loop refrigeration cooling systems, is exempt from strict potability standards. However, any water that directly contacts food, food-contact surfaces, or the hands of food handlers must meet rigid microbiological and chemical potability criteria.

26. (C) Statement I is correct but Statement II is incorrect.
Steam that contacts food or food-contact surfaces must be generated from potable water to prevent chemical or microbial contamination. Furthermore, all chemical additives used in the boiler system to prevent corrosion or scaling are strictly regulated, as volatile compounds can carry over into the steam and contaminate the processed food products.

27. (A) Storing empty containers inverted in a clean, protected environment
Storing empty food containers in an inverted position inside a clean, enclosed area prevents airborne dust, moisture, and pests from settling inside. This practice minimizes the risk of introducing secondary microbial contaminants to the packaging before filling. It provides a simple and highly effective physical control measure in food plants.

28. (C) Post-lethality cross-contamination from slicing equipment biofilms
Ready-to-eat meats can undergo post-lethality contamination during slicing and packaging operations. Even if the meat is fully cooked, Listeria monocytogenes can colonize slicing machinery and form persistent biofilms. As the cooked meat passes through the slicer, the physical friction dislodges bacteria from the biofilm, contaminating the finished product.

Click Here to Buy book on Amazon

69. (A) 1, 2 and 3
Traditional plate counts cannot differentiate between harmless spoilage organisms and pathogens, nor can they detect viable but non-culturable cells. Additionally, the results are highly dependent on the chosen media, temperature, and incubation atmosphere. However, these methods are simple and do not require DNA sequencing equipment for basic enumeration.

70. (C) Obligate thermophilic archaea
Obligate thermophilic organisms require highly specialized, anaerobic, high-temperature growth conditions, often exceeding sixty degrees Celsius, as well as specific nutrients to replicate. Consequently, these organisms will fail to form colonies under standard mesophilic incubation conditions, meaning they are not captured during routine plate counts performed at thirty-five degrees Celsius.

71. (D) Statement I is incorrect but Statement II is correct.
A low viable cell count does not guarantee the absence of microbial toxins. For example, enterotoxigenic bacteria can grow and produce toxins in food during temperature abuse. If the food is subsequently heated, the vegetative cells are destroyed, resulting in a low plate count, but the heat-stable toxins remain active and can cause illness.

72. (A) 2, 3, 1, 4
Freshly slaughtered meat initially harbors a low, diverse microbial population. During refrigerated storage, psychrotrophic bacteria grow rapidly and dominate the surface. These bacteria exhaust the available surface glucose and then transition to metabolizing amino acids. This protein breakdown produces alkaline compounds like ammonia and amines, causing off-odors and slime.

73. (B) The raw milk contained high numbers of thermoduric bacteria.
Thermoduric microorganisms can survive pasteurization temperatures without multiplying. If raw milk contains high populations of these heat-resistant organisms, they will survive the pasteurization process and be detected in the finished product. This leads to a high plate count immediately after processing, even when the pasteurization equipment is operating correctly.

74. (B) They grow very rapidly at refrigeration temperatures.
Psychrotrophic bacteria possess physiological adaptations, such as flexible cell membranes rich in unsaturated fatty acids, that allow them to grow rapidly under refrigeration. This rapid growth rate allows them to outcompete mesophilic organisms on aerobically stored fresh meat, quickly reaching populations that cause sensory spoilage, off-odors, and surface slime.

75. (A) The beef is at the threshold of incipient spoilage.
In food microbiology, a total aerobic plate count reaching ten million colony-forming units per gram is recognized as the threshold for incipient spoilage. At this microbial density, the bacterial population begins to produce detectable off-odors, surface slime, and discoloration, indicating that the product is reaching the end of its shelf life.

76. (C) It contains indicators that distinguish microbes based on biochemical traits.
Differential media contain specific chemical compounds, such as pH indicators, chromogenic substrates, or blood, that allow visual differentiation of bacterial colonies based on their biochemical activities. This enables analysts to distinguish target organisms from surrounding background flora on the same plate, without necessarily inhibiting the growth of non-target species.

77. (D) Violet Red Bile Agar (VRBA)
This selective and differential medium is used to enumerate coliform bacteria in food and dairy products. It contains bile salts and crystal violet to inhibit Gram-positive organisms, while neutral red serves as a pH indicator. Coliforms ferment the lactose in the agar, producing acid that turns the colonies red-purple with a zone of precipitation.

78. (A) Both A and R are true and R is the correct explanation of A.
Membrane filtration is highly effective for testing clean water samples with very low expected microbial counts. Passing large volumes of water through a sterile membrane filter traps the bacterial cells on the filter surface. The membrane is then placed on agar, allowing colonies to grow and providing accurate quantification of low microbial populations.

Downloaded from www.pdf.tube

39. (A) 1, 2 and 3
Human operators continuously shed skin cells, hair, and respiratory droplets, making them a primary source of contamination in clean rooms. High-efficiency filters capture 99.97% of particles down to 0.3 micrometers, and increasing air changes per hour rapidly dilutes airborne contaminants. Conversely, passive settle plates do not measure a defined volume of air.

40. (A) Nutritional composition of the air
Microorganisms cannot grow or replicate while suspended in the air due to the lack of liquid water and accessible nutrients. Consequently, the nutritional composition of the air does not affect their survival. Instead, physical environmental factors such as temperature, relative humidity, and ultraviolet light exposure determine how long suspended microbes remain viable.

41. (D) Statement I is incorrect but Statement II is correct.
Gowning procedures in food clean rooms are designed to protect the food product from human-derived contaminants, rather than protecting the operator from the food. Clean room garments act as a physical barrier that contains shed skin flakes, hair, and microflora, preventing these particulates from entering the sterile processing environment.

42. (A) 3, 1, 2, 4
To maintain clean room integrity, personnel must follow a strict entry sequence. First, hands are thoroughly washed and sanitized. Next, protective headwear and face masks are donned to contain respiratory droplets and hair. Dedicated clean room footwear is then put on, and finally, operators pass through an air shower to remove loose particulates.

43. (A) Maintenance of positive pressure in high-risk areas
High-risk areas such as slicing and packaging rooms must maintain positive air pressure relative to adjacent zones. If pressure drops, air from dirtier areas like raw mixing will flow into the packaging room, carrying mold spores and other contaminants. Correcting this pressure gradient is essential to prevent airborne cross-contamination of products.

NODIA

44. (C) It promotes surface condensation, creating micro-environments for growth.
High relative humidity within clean rooms can cause moisture to condense on cold equipment and building surfaces. This localized condensation creates high water activity micro-environments that allow bacterial cells and mold spores to germinate and multiply. Controlling humidity levels is therefore critical to prevent the development of localized contamination sources.

45. (D) 50 CFU/m^3
Calculating airborne concentration requires dividing the total colony count by the total volume of air sampled. A flow rate of 100 liters per minute for 10 minutes yields a total sample volume of 1,000 liters, which equals exactly one cubic meter. Therefore, a count of 50 colonies corresponds directly to 50 CFU/m^3.

46. (C) Deeply embedded skin microorganisms that are difficult to remove by handwashing.
Resident skin flora consists of microorganisms that live and multiply in the deeper layers of the stratum corneum, sebaceous glands, and hair follicles. Unlike transient flora, which are easily removed by routine washing, these resident microbes are deeply embedded and require surgical-grade scrubs or active sanitizers to significantly reduce their populations.

47. (B) Staphylococcus aureus
This bacterium is a common inhabitant of human skin, nasal passages, and throat, and is highly concentrated in infected cuts or lesions. When food handlers touch their face or nose and then handle food without washing their hands, they easily transfer these toxigenic bacteria, which can then multiply and produce heat-stable enterotoxins.

48. (A) Both A and R are true and R is the correct explanation of A.
Handwashing relies on both chemical and physical mechanisms to clean the skin. While surfactants emulsify lipids, physical friction is necessary to dislodge transient pathogens, dead skin cells, and organic soils trapped in skin folds. This mechanical action allows the running water to wash away contaminants that would otherwise remain attached to the hands.

89. (B) Thermal shock and lethality to vegetative cells, reducing the overall count.
Pouring molten agar at temperatures above 50°C exposes the microorganisms in the sample to thermal stress. This heat exposure can cause sublethal injury or direct cell death in vegetative bacterial and fungal cells, resulting in artificially low plate counts and underestimating the true microbial population present in the food product.

90. (B) Using the Most Probable Number (MPN) method.
The Most Probable Number method is a dilution-to-extinction, tube-based assay used to estimate low microbial populations in highly turbid or particulate-heavy food samples. Because it uses liquid enrichment broths rather than solid agar plates, it is not affected by sample turbidity or particulates that would interfere with membrane filtration or plate counting.

91. (A) To lower the medium pH to approximately 3.5, suppressing bacterial growth.
Adding a specific concentration of sterile tartaric acid to Potato Dextrose Agar lowers the pH of the medium to approximately 3.5. This highly acidic environment inhibits the growth of most bacteria while allowing acid-tolerant yeasts and molds to proliferate, enabling selective enumeration of fungi from food samples without bacterial interference.

92. (C) Norovirus
This highly infectious virus is the leading cause of non-bacterial gastroenteritis outbreaks worldwide. It is transmitted primarily via the fecal-oral route, often through contaminated food or water or direct person-to-person contact. Infected food handlers shedding the virus can easily contaminate ready-to-eat foods, leading to widespread outbreaks due to the low infectious dose.

93. (A) Both A and R are true and R is the correct explanation of A.
Acidifying media can stress and inhibit injured fungal cells, and heating acidified agar can hydrolyze the polysaccharide chains, preventing proper gelation. Supplementing the medium with neutral-pH antibiotics, such as chloramphenicol, suppresses bacterial growth without stressing injured fungi or affecting the physical strength of the agar gel.

94. (C) Viruses require living host cells to replicate, preventing growth in standard broths.
Foodborne viruses are obligate intracellular parasites that require living host cells to replicate. Unlike bacteria and fungi, they cannot grow or multiply in cell-free nutrient broths or agar media. This biological requirement makes traditional culture-dependent isolation and enumeration methods inapplicable, requiring the use of molecular or immunological detection assays.

95. (B) They actively replicate and increase their numbers on the surface of raw produce during cold storage.
Protozoan parasites are eukaryotic organisms that require a host organism to complete their life cycle and replicate. They cannot multiply or increase their numbers in or on food products during storage. Instead, food serves as a vehicle for transmitting the infective cyst stage, which remains dormant until ingested by a host.

96. (A) P-III, Q-IV, R-I, S-II
Acidified agar media support the selective growth of yeasts and molds, while enzyme-linked assays detect specific viral or bacterial antigens. Molecular amplification via reverse transcription polymerase chain reaction targets viral RNA genomes, and immunomagnetic separation coupled with microscopy is used to capture and visualize larger parasitic protozoan oocysts.

97. (A) Toxoplasma gondii – Undercooked meat and contact with cat feces
This protozoan parasite is transmitted to humans through the ingestion of infectious oocysts shed in feline feces, or by consuming undercooked meat containing tissue cysts. It represents a significant foodborne pathogen, particularly for pregnant women and immunocompromised individuals, highlighting the need for proper meat cooking and hygiene practices.

98. (C) Hepatitis A virus – Buffered Peptone Water enrichment
Hepatitis A is an obligate intracellular virus that cannot replicate in cell-free microbiological media like Buffered Peptone Water. While this enrichment broth is used to resuscitate and culture enteric bacteria like Salmonella, viral detection requires physical extraction and concentration followed by molecular assays like RT-PCR to amplify viral nucleic acids.

Click Here to Buy book on Amazon

15. Based on a three-class sampling plan for a particular processed food, the criteria are $n = 5$, $c = 2$, $m = 10^3\, CFU/g$, and $M = 10^4\, CFU/g$. You test five samples and obtain the following counts: 5×10^2 , 2×10^3, 4×10^3, 6×10^3, and 8×10^2.
What is the correct interpretation?
(A) The batch is accepted because all five analyzed samples are strictly below the hazardous limit M.
(B) The batch is accepted because exactly three samples fall within the marginal range between m and M.
(C) The batch is rejected because at least one sample has been found to exceed the safety limit M.
(D) The batch is rejected because three samples exceed the limit m, which is more than c.

16. Which specific bacterium is widely considered the most reliable indicator of recent faecal contamination in food and water?
(A) Bacillus subtilis
(B) Staphylococcus epidermidis
(C) Escherichia coli
(D) Pseudomonas aeruginosa

17. Consider the following statements regarding Total and Faecal Coliforms:
I. Total coliforms include environmental genera such as Enterobacter and Klebsiella.
II. Faecal coliforms are distinguished by their ability to ferment lactose with gas production at elevated temperatures (44.5°C).
III. All total coliforms are faecal coliforms.
IV. E. coli is a prominent member of the faecal coliform group.
Which of the above statements are correct?
(A) I, II, and IV only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and III only

18. How is the family Enterobacteriaceae defined in the context of food microbiology?
(A) Gram-positive, spore-forming bacilli that exclusively inhabit the human gut
(B) Acid-fast bacteria that primarily cause severe spoilage in high-sugar foods
(C) Spiral-shaped microaerophiles that indicate cross-contamination in raw meat
(D) Gram-negative, non-sporing, glucose-fermenting, oxidase-negative rods

19. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Enterococci are often used as alternative hygiene indicators in frozen or dried foods.
Reason (R): Enterococci are highly susceptible to freezing and desiccation, making them ideal to indicate slight temperature abuse.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

20. Which of the following statements correctly identifies a characteristic of the total coliform group?
(A) They are taxonomically defined as Gram-positive, spore-forming coccal bacteria.
(B) They are exclusively of animal faecal origin and are never found in soil or vegetation.
(C) They ferment lactose, producing acid and gas in 48 hours at $35^{\circ}C - 37^{\circ}C$.
(D) They require strictly anaerobic atmospheric conditions to actively metabolize glucose.

21. Match List I with List II:
List I: (Indicator Group)
P. Total Coliforms
Q. Faecal Coliforms
R. E. coli
S. Enterococci
List II: (Key Characteristic/Significance)
I. Thermotolerant lactose fermenters
II. Highly resistant to freezing and high salt; Gram-positive
III. Broad group including soil and plant inhabitants
IV. Specific indicator carrying the uidA gene (beta-glucuronidase)
(A) P-III, Q-I, R-IV, S-II
(B) P-I, Q-III, R-IV, S-II
(C) P-III, Q-IV, R-I, S-II
(D) P-IV, Q-I, R-III, S-II

22. Which of the following statements regarding E. coli as a faecal indicator is incorrect?
(A) It is the predominant facultative anaerobe in the human intestinal tract.
(B) It is generally not found multiplying in pristine natural waters.

109. (D) They bypass the plate count anomaly and can detect VBNC organisms.
A key advantage of culture-independent profiling methods is their ability to bypass the plate count anomaly by detecting DNA from all cells in a sample. This allows for the identification of viable but non-culturable organisms and species that do not grow on standard agar, providing a more complete representation of the microbiome.

110. (C) It requires microbial cultivation in enrichment broth prior to analysis.
Temperature Gradient Gel Electrophoresis is a culture-independent technique that analyzes DNA extracted directly from the food matrix, avoiding the need for prior cultivation. It separates PCR amplicons along a physical temperature gradient based on sequence-dependent melting behavior, making it a valuable tool for monitoring microbial community dynamics during food processing.

111. (A) P-II, Q-IV, R-I, S-III
Molecular profiling techniques utilize distinct separation principles. Chemical denaturants separate double-stranded amplicons, while thermal gradients achieve the same based on melting temperatures. Single-stranded conformation analysis relies on secondary folding structures, and terminal restriction fragment analysis separates fluorescently labeled fragments based on specific restriction enzyme cleavage sites.

112. (D) DGGE – Requires a GC-clamp attached to one of the PCR primers.
Denaturing Gradient Gel Electrophoresis requires attaching a forty-base-pair, GC-rich sequence to one of the PCR primers. This GC-clamp acts as a high-melting-temperature domain that prevents the double-stranded DNA amplicons from completely dissociating into single strands during electrophoresis, preserving the sequence-dependent migration differences in the gel.

113. (A) Metagenomics – Purifying individual bacterial toxins from a food matrix
Metagenomics is a high-throughput sequencing method used to analyze the collective genetic material of a microbial community, rather than purifying physical proteins or toxins. Chemical purification and mass spectrometry are used for toxin analysis, while metagenomics is applied to profile microbial diversity and identify functional genes within food ecosystems.

114. (A) 1, 2 and 3
PCR-based profiling methods can be biased by incomplete cell lysis or the generation of chimeric sequences during amplification. Additionally, these assays amplify DNA from both dead and viable cells, which can complicate viability assessments. They do not provide direct, real-time measurements of the active enzymatic processes within the community.

115. (A) High-Performance Liquid Chromatography (HPLC)
High-Performance Liquid Chromatography is a chemical separation technique used to analyze non-volatile compounds, such as organic acids, sugars, and toxins, in food. Unlike gel-based molecular methods like DGGE, SSCP, and T-RFLP, HPLC does not analyze nucleic acids and is not used as a genetic fingerprinting tool for microbial communities.

116. (D) Statement I is incorrect but Statement II is correct.
Stressed bacteria entering the viable but non-culturable state reduce their metabolic activity but remain alive and capable of causing infection. Because they cannot grow on agar, they are missed by culture methods. Culture-independent molecular assays detect their DNA directly, making these techniques valuable for identifying these dormant pathogens.

117. (B) Excise the band, re-amplify the DNA, and sequence it.
To identify a bacterial species represented by a specific band on a denaturing gel, the analyst must physically cut the band from the gel matrix. The trapped DNA is eluted, re-amplified using PCR, and sequenced. The resulting nucleotide sequence is then compared against reference databases to determine taxonomic identity.

118. (C) Temporal profiling using DGGE
To monitor the succession of lactic acid bacteria during cheese ripening without cultivation, temporal profiling using Denaturing Gradient Gel Electrophoresis is highly effective. Extracting DNA directly from cheese samples at different time points and running amplicons on a single denaturing gel allows researchers to visualize shifts in species dominance over time.

Downloaded from www.pdf.tube

119. (D) Fragments will completely dissociate into single strands, causing loss of resolution.
Without a high-melting GC-clamp, the double-stranded DNA amplicons will completely denature into individual single strands as they migrate through the chemical gradient. This complete dissociation prevents the sequence-specific halting of migration, resulting in a loss of resolution and preventing the separation of fragments with minor sequence differences.

120. (A) Single-Strand Conformation Polymorphism (SSCP)
Single-Strand Conformation Polymorphism does not require specialized equipment to establish chemical or thermal gradients. Instead, amplicons are denatured into single strands and separated on a standard polyacrylamide gel under constant conditions. The single strands fold into conformation-specific three-dimensional shapes, separating based on physical shape rather than melting behavior.

121. (B) Direct sequencing of collective genomic DNA from a food community.
Metagenomics is the direct, high-throughput sequencing of the collective genomic DNA extracted from an entire microbial community within a sample. This approach avoids the need for isolation or cultivation, allowing for comprehensive profiling of taxonomic diversity and metabolic potential, including unculturable or rare members of the food microbiome.

122. (B) Ribosomal proteins
In MALDI-TOF Mass Spectrometry, intact microbial cells or lysates are co-crystallized with a chemical matrix and ionized by a laser. The instrument measures the mass-to-charge ratio of highly abundant, conserved ribosomal proteins. The resulting spectral fingerprint is compared against a reference database to rapidly identify the microorganism at the species level.

123. (A) Both A and R are true and R is the correct explanation of A.
Digital PCR provides absolute quantification of target DNA without relying on a standard reference curve. By partitioning the sample into thousands of individual micro-reactions, some partitions receive target molecules while others do not. Following end-point amplification, applying Poisson statistics to the ratio of positive to negative partitions yields the absolute concentration of target DNA.

124. (C) qPCR measures DNA amplification in real-time, whereas conventional PCR is an end-point assay.
Quantitative PCR monitors the amplification of target DNA in real-time during each cycle using fluorescent dyes or probes. This continuous measurement allows for quantification of the initial template concentration. In contrast, conventional PCR is an end-point assay that requires post-amplification gel electrophoresis to visualize the final product, providing only qualitative results.

125. (D) NGS provides instantaneous, point-of-care results within minutes directly on the factory floor.
Next-Generation Sequencing is a laboratory-bound technology that requires multi-step sample preparation, sequencing runs, and complex bioinformatic processing. It cannot provide instantaneous results within minutes on a factory floor. Instead, it is used for high-resolution pathogen traceback, metagenomic profiling, and identifying antimicrobial resistance genes in reference laboratories.

126. (A) P-II, Q-I, R-IV, S-III
Advanced analytical platforms rely on distinct physical and chemical mechanisms. Quantitative PCR monitors fluorescence during cycling, while mass spectrometry analyzes ribosomal proteins from ionized cells. High-throughput sequencing generates millions of reads simultaneously, and digital PCR partitions samples into micro-reactions to achieve absolute quantification of target DNA without standard curves.

127. (B) Chemical Matrix – Assists laser-driven analyte ionization
In MALDI-TOF Mass Spectrometry, the chemical matrix absorbs the energy from the laser pulse and transfers it to the target molecules, such as ribosomal proteins. This energy transfer facilitates the ionization and desorbtion of the analytes without causing thermal degradation, enabling precise mass-to-charge analysis in the vacuum chamber.

128. (D) Conventional PCR – Highly precise real-time absolute quantification
Conventional PCR is a qualitative, end-point assay that determines only the presence or absence

NODIA

of a target sequence. It cannot provide precise real-time quantification, which requires real-time quantitative PCR or digital PCR platforms. Standard plate counts estimate viable, culturable cells, while digital PCR achieves absolute quantification through sample partitioning.

129. (A) 1, 2 and 4
Metagenomics is a powerful tool for identifying novel spoilage organisms, mapping antimicrobial resistance genes, and characterizing the microbial ecology of fermented foods. However, it still requires rigorous sample preparation, including high-quality genomic DNA extraction and library preparation, to generate reliable sequencing data from complex food matrices.

130. (C) Subjecting the sample to a highly concentrated gradient of urea to denature the DNA.
MALDI-TOF Mass Spectrometry analyzes abundant ribosomal proteins rather than DNA. The protocol involves smearing a colony onto a target plate, overlaying it with a chemical matrix, and ionizing the proteins with a laser pulse inside a vacuum. It does not involve urea denaturing gradients, which are used in molecular profiling methods.

131. (A) Both Statement I and Statement II are correct.
The cycle threshold is the PCR cycle number at which the reporter fluorescence crosses the background threshold. Because amplicons double with each cycle, samples with higher initial target DNA concentrations cross this threshold earlier. Therefore, a lower cycle threshold value directly correlates with a higher initial concentration of target DNA.

132. (A) 2, 3, 4, 1
The workflow for identifying an outbreak strain using whole genome sequencing begins with extracting high-quality genomic DNA from a pure culture. This DNA is fragmented, and adapters are attached to prepare the library. The library is then sequenced to generate millions of reads, which are assembled and compared bioinformatically.

133. (B) Facility A is strongly implicated as the outbreak source.
Whole Genome Sequencing provides high-resolution genetic comparison of bacterial isolates. A zero single-nucleotide polymorphism difference between clinical isolates and isolates from Facility A indicates that they are clonal, strongly implicating this facility as the source. The high SNP variation from Facility B rules it out as the source of this outbreak.

134. (C) They act as PCR inhibitors, binding to polymerase or DNA and causing false negatives.
Complex food matrices often contain compounds like lipids, polyphenols, humic acids, and proteins that can interfere with PCR. These compounds can bind to the DNA polymerase enzyme or the template DNA, blocking the amplification reaction. This inhibition can lead to false-negative results, requiring robust extraction protocols to remove inhibitors.

135. (D) Treating the sample with PMA to inhibit dead-cell DNA amplification.
Propidium monoazide is a DNA-binding dye that penetrates only dead cells with compromised membranes. Once inside, it photolink-binds to the DNA upon light exposure, preventing its amplification. Because live cells have intact membranes, they exclude PMA, leaving their DNA free to be amplified, enabling viable-cell PCR detection.

136. (A) A device combining a bioreceptor and a transducer to produce a measurable signal.
A biosensor is an analytical device that integrates a biological recognition element, such as an antibody or nucleic acid, with a physical transducer. The bioreceptor binds to the target pathogen or toxin, and the transducer converts this biological interaction into a measurable optical, electrochemical, or mass signal for rapid analysis.

137. (B) Luciferase and Luciferin
Hygiene monitoring assays utilize the firefly luciferase enzyme, which catalyzes the oxidation of luciferin in the presence of adenosine triphosphate and oxygen. This reaction produces light in direct proportion to the amount of ATP present. Measuring this bioluminescence provides a rapid estimate of the organic residue and microbial load on surfaces.

138. (C) A is true but R is false.
ATP swabbing is a highly effective tool for real-time verification of cleaning and sanitation because it detects adenosine triphosphate, which is present in all living cells and food residues. However, it is not specific to pathogens and

Click Here to Buy book on Amazon

cannot differentiate between microbial ATP and harmless organic food residues left on surfaces.

139. (A) It involves capillary flow of a sample across a membrane with antibody-coupled reporter particles.
Lateral Flow Assays are rapid, paper-based diagnostic platforms. The liquid sample moves via capillary action across a membrane, where target antigens bind to colored or fluorescent antibody-coupled reporter particles. These complexes are captured by a second line of immobilized antibodies, producing a visible line that confirms the presence of the pathogen.

140. (C) 'm' is the limit above which product is deemed hazardous and rejected.
In a three-class sampling plan, the parameter 'm' represents the limit separating good quality from marginally acceptable quality. It does not represent the hazardous threshold, which is defined by the parameter 'M'. Any single sample unit exceeding 'M' indicates unacceptable quality and results in the rejection of the entire product lot.

141. (A) P-III, Q-II, R-I, S-IV
Standardized sampling plans use defined parameters to evaluate food lots. The number of samples tested is represented by 'n', while 'c' defines the maximum allowed marginal results. The threshold separating acceptable from marginal quality is 'm', and 'M' represents the absolute upper limit above which any sample count results in rejection.

142. (C) Sandwich ELISA – Antigen is captured between two specific antibodies
The sandwich ELISA format is widely used for detecting foodborne pathogens and toxins. In this setup, the target antigen is physically captured between a solid-phase-bound antibody and an enzyme-conjugated detection antibody. This double-binding mechanism provides high specificity and sensitivity, making it a reliable tool for food safety testing.

143. (B) Impedance microbiology – Rapid detection of viral capsids
Impedance microbiology is used to detect active microbial growth by measuring changes in electrical resistance or conductance as bacteria metabolize nutrients. It cannot detect inactive viral capsids, which do not multiply or metabolize. In contrast, lateral flow strips detect antigens, and molecular assays target viral genetic material.

144. (A) 2 and 4
Under a three-class sampling plan, a lot is rejected if any sample exceeds the absolute limit 'M', or if the number of samples between 'm' and 'M' exceeds 'c'. In scenario two, three samples are marginal, which exceeds the allowed count of two, and in scenario four, one sample exceeds 'M', leading to rejection.

145. (A) High-efficiency particulate air (HEPA) filter
A biosensor is composed of a biological recognition element, a physical transducer, and a signal processing unit. It does not contain a HEPA filter, which is an air filtration technology used to remove particles from ventilation systems. Biosensors are used to rapidly detect pathogens, toxins, or chemical contaminants in food.

146. (C) Statement I is correct but Statement II is incorrect.
CODEX guidelines state that microbiological criteria should be based on risk analysis and epidemiological data. However, a two-class sampling plan does not use the parameter 'M' to evaluate marginal quality. Instead, it utilizes only 'n', 'c', and 'm' to classify samples simply as acceptable or unacceptable, with no marginal category.

147. (A) Immediately reclean, resanitize, and re-swab the slicer before production.
An ATP reading of forty-five hundred relative light units indicates significant organic residue and sanitation failure on the food-contact surface. To prevent product cross-contamination, the immediate corrective action is to reclean, resanitize, and re-swab the equipment to verify cleaning efficacy before allowing any food production to begin.

148. (D) Accept the batch because only one sample is between 'm' and 'M'.
The testing results show that four samples are below the limit 'm', and only one sample falls between 'm' and 'M'. Under the specified sampling plan, a maximum of one sample is allowed to have a marginal count within this range. Because this condition is met, the officer should accept the batch.

NODIA

149. (B) The test will yield a very high RLU reading due to somatic ATP in the food residue.
Swabbing visible food residue will yield an extremely high bioluminescence reading. This is because the food residue contains high concentrations of somatic ATP, which reacts with the luciferase enzyme in the swab. The test cannot differentiate between ATP from food and ATP from bacteria, indicating that the surface is dirty.

150. (C) A 2-class plan with n = 60, c = 0, requiring pathogen absence.
For high-risk pathogens in foods consumed by sensitive populations, such as Cronobacter in infant formula, regulatory agencies use a stringent two-class sampling plan. Testing sixty samples with zero tolerance for positive results ensures a high probability of detecting low-level contamination, providing the necessary level of protection for consumer safety.

NODIA

www.nodia.in

CHAPTER 11

Microbiological Examination, MPN and Indicator Microorganisms

1. Which of the following is the primary principle behind the microbiological examination of foods?
(A) To quantify the total chemical preservatives and synthetic additives present in the food matrix
(B) To assess food safety, quality, and shelf-life by measuring target microbial populations
(C) To identify all specific genetic mutations and plasmid profiles in foodborne pathogens
(D) To sterilize the food product and eliminate organic contaminants prior to chemical profiling

2. Consider the following statements regarding sampling plans for microbiological testing:
I. A two-class plan is typically used for presence/absence testing of severe pathogens.
II. A three-class plan includes an intermediate marginal acceptable quality range.
III. In a three-class plan, 'm' represents the maximum unacceptable microbial limit.
IV. 'c' represents the maximum allowable number of sample units yielding marginal results in a three-class plan.
Which of the above statements are correct?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

3. In the context of sample preparation for microbiological analysis, how is "homogenisation" best defined?
(A) Mechanical breakdown of a sample to evenly distribute microbes in a diluent
(B) Thermal treatment of a sample at specific temperatures to eliminate background microflora
(C) Chemical digestion of food matrices utilizing standardized concentrated acid solutions
(D) Statistical selection of representative portions to ensure a uniform batch sample size

4. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Serial dilution is an essential step when examining foods expected to have high microbial loads.
Reason (R): Serial dilution concentrates the microorganisms, making it easier to isolate them on a single agar plate.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

5. Which of the following statements correctly describes a component of the three-class sampling plan?
(A) The value 'M' represents the threshold limit above which a sample is completely unacceptable.
(B) The value 'n' indicates the total volume of liquid diluent required per sample in milliliters.
(C) The value 'c' indicates the minimum number of collected sample units that must show zero microbial growth.
(D) The value 'm' denotes the maximum number of total batch sample units tested in a single analytical run.

6. Match List I with List II:
List I: (Sampling Terminology)
P. n
Q. c
R. m
S. M
List II: (Definition)
I. Marginal limit of acceptable quality
II. Maximum allowable number of marginally acceptable units
III. Number of sample units drawn from a lot

Downloaded from www.pdf.tube

IV. Unacceptable / hazardous microbial limit
(A) P-III, Q-II, R-I, S-IV
(B) P-III, Q-I, R-II, S-IV
(C) P-II, Q-III, R-I, S-IV
(D) P-IV, Q-II, R-I, S-III

7. Which of the following statements is incorrect regarding the concept of indicator microorganisms?
(A) They are used to assess the overall sanitation and hygiene of a processing environment.
(B) Their presence always indicates the definite presence of specific pathogenic bacteria.
(C) They should ideally be present when pathogens are present and absent when pathogens are absent.
(D) They should be relatively easy and quick to detect compared to target pathogens.

8. Consider the following steps of sample preparation and serial dilution:
I. Transfer 1 mL from the initial suspension to a tube containing 9 mL of diluent.
II. Weigh 25 g of the solid food sample.
III. Blend the mixture in a stomacher for 1 to 2 minutes.
IV. Add the sample to 225 mL of sterile peptone water.
Which of the following represents the correct sequence of these steps?
(A) II - IV - III - I
(B) II - III - IV - I
(C) IV - II - I - III
(D) II - IV - I - III

9. Given below are two statements:
Statement I: The use of a stomacher is generally preferred over a rotary blender for food homogenisation because it generates less heat.
Statement II: Rotary blenders are easier to clean and sterilize between samples than stomacher bags.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

10. Which of the following pairs of indicator microorganisms and their specific indication is correctly matched?
(A) Enterobacteriaceae — Failure of post-process hygiene
(B) Total Coliforms — Fresh human faecal contamination proof
(C) Enterococci — Indicator of strict anaerobic spoilage
(D) E. coli — Indicator of improper freeze-drying operations

11. A food safety officer is testing a batch of ready-to-eat infant formula. The presence of even a single Salmonella cell is considered hazardous. Which sampling plan concept is most appropriate to apply for Salmonella detection in this scenario?
(A) A three-class plan where $c > 0$
(B) A two-class plan where $c = 0$
(C) A continuous variables sampling plan
(D) A random non-statistical spot check

12. Which of the following pairs concerning sample homogenisation is incorrectly matched?
(A) Diluent — 0.1% Peptone water
(B) Stomacher bag — Reusable glass container
(C) Sample to diluent ratio — Generally 1:10
(D) Homogenisation time — Usually 1 to 2 minutes

NODIA

13. A laboratory technician receives a hard, block cheese sample for microbiological testing. Standard blending fails to break it down sufficiently without causing excessive friction and heat. What is the most appropriate next step to prepare this sample accurately?
(A) Aseptically grate the cheese and add it to a pre-warmed diluent at 40°C
(B) Completely incinerate the cheese block in a muffle furnace and run standard tests on the ash
(C) Melt the cheese completely at 100°C in a water bath before blending with the diluent
(D) Dissolve the sample in highly concentrated hydrochloric acid to release trapped organisms

14. Which of the following is NOT an ideal characteristic of a faecal indicator microorganism?
(A) It should be universally present in the intestines of humans and warm-blooded animals.
(B) It should be easily detected and enumerated by standard laboratory methods.
(C) It should multiply rapidly outside the host in natural water environments.
(D) Its survival time in the environment should be similar to or slightly longer than associated pathogens.

99. (A) 1, 2 and 3
Detecting foodborne viruses requires eluting the particles from the food surface, concentrating them using physical or chemical methods, and extracting the viral nucleic acids for molecular analysis. Because viruses do not replicate or cause turbidity in cell-free nutrient broths, they cannot be quantified using traditional turbidimetric methods.

100. (D) They produce enterotoxins in food prior to ingestion.
Human enteric viruses do not produce toxins, nor do they possess metabolic pathways to synthesize enterotoxins in food. Instead, they cause illness by invading and replicating inside the host's intestinal cells after ingestion. Additionally, they do not cause sensory spoilage, allowing contaminated food to appear, smell, and taste normal.

101. (D) Statement I is incorrect but Statement II is correct.
Direct microscopy is not used for routine foodborne virus testing due to the extremely small size of viral particles and low contamination levels in food. Instead, molecular methods like quantitative polymerase chain reaction are the gold standard because they can detect very low concentrations of viral genetic material with high specificity.

102. (A) 2, 4, 1, 3
The workflow for detecting RNA viruses in food begins with eluting and concentrating the viral particles from the food matrix. Next, the viral RNA is extracted from these concentrated particles. This RNA is then reverse-transcribed into complementary DNA, which is amplified and quantified using real-time polymerase chain reaction.

103. (D) Cyclospora cayetanensis
This protozoan parasite produces spherical oocysts measuring eight to ten micrometers that are acid-fast positive. It is a well-documented cause of waterborne and foodborne gastroenteritis, often associated with contaminated fresh produce like basil, cilantro, or berries. The low infectious dose can lead to prolonged outbreaks of watery diarrhea.

104. (A) Minor filtration breakdowns can lead to large-scale outbreaks.
Because protozoan parasites have an extremely low infectious dose, even minor physical filtration failures in water treatment plants can allow enough oocysts to pass through to cause widespread outbreaks. These cysts are highly resistant to chemical disinfectants like chlorine, making physical filtration barriers critical for ensuring water safety.

105. (B) The presence of viral RNA does not definitively confirm infectivity.
Polymerase chain reaction assays amplify target DNA or RNA sequences, regardless of whether the source virus is intact and infectious or has been inactivated by treatments like freezing. A positive molecular result indicates that the viral genetic material is present, but it does not confirm that the virus is capable of causing infection.

106. (B) Methods that analyze pathogens directly from the food sample without prior cultivation.
Culture-independent methods analyze microorganisms directly from food samples without requiring cultivation on agar media. These techniques bypass the limitations of selective plating by targeting microbial DNA, RNA, proteins, or metabolites directly, allowing for rapid detection and profiling of the entire microbial community, including unculturable or stressed cells.

107. (A) 16S rRNA gene
The gene encoding the small ribosomal subunit RNA is universally present in all bacteria and contains highly conserved regions interspersed with variable regions. This structure makes it the primary target for molecular community profiling and taxonomic identification, allowing researchers to characterize complex bacterial populations in food ecosystems without cultivation.

108. (A) Both A and R are true and R is the correct explanation of A.
Denaturing Gradient Gel Electrophoresis separates DNA amplicons of identical size based on differences in their nucleotide sequences. As the fragments migrate through an increasing gradient of chemical denaturants, sequences with different base compositions denature at different points. This denaturation halts migration, resulting in distinct bands on the gel.

Click Here to Buy book on Amazon

(C) Its presence in heat-treated foods suggests inadequate processing or post-processing contamination.
(D) All strains of E. coli are highly pathogenic and cause severe foodborne illness.

23. Consider the following steps in the standard Most Probable Number (MPN) method for detecting coliforms in water:
I. Inoculate varying volumes of sample into lactose broth tubes.
II. Perform a Gram stain and streak on agar slants.
III. Incubate presumptive tubes at 35°C and check for gas production.
IV. Transfer from gas-positive tubes to Brilliant Green Bile (BGLB) broth.
Which of the following represents the correct sequence of these steps?
(A) I - III - IV - II
(B) I - IV - III - II
(C) III - I - IV - II
(D) I - III - II - IV

24. Given below are two statements:
Statement I: The IMViC test series is used to differentiate members of the coliform group, specifically distinguishing E. coli from Enterobacter aerogenes.
Statement II: A typical E. coli strain gives an IMViC pattern of Indole (-), Methyl Red (-), Voges-Proskauer (+), and Citrate (+).
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

25. Which of the following pairs regarding IMViC tests is correctly matched?
(A) Indole test — Detects enzymatic degradation of glucose into mixed organic acids
(B) Methyl Red test — Identifies the bacterial production of neutral acetoin
(C) Voges-Proskauer test — Detects the conversion of amino acid tryptophan to indole
(D) Citrate test — Detects utilization of citrate as the sole carbon source

26. A food safety laboratory detects high levels of total coliforms but absolutely zero faecal coliforms or E. coli in a batch of fresh vegetables. What is the most scientifically sound conclusion based on indicator concepts?
(A) Coliforms likely originate from the soil rather than direct faecal pollution.
(B) The food product is highly contaminated with fresh human or animal faecal matter.
(C) The agricultural crops were definitely irrigated or washed using raw sewage water.
(D) The food sample is completely sterile and safe for consumption by high-risk patients.

NODIA

27. Which of the following pairs regarding indicator microbes is incorrectly matched?
(A) Thermotolerant coliforms — Incubated at 44.5°C
(B) Enterococci — Gram-negative rods found in the intestine
(C) Enterobacteriaceae — Includes Salmonella and Shigella
(D) E. coli type I — Produces indole at 44°C

28. In a routine hygiene inspection of a pasteurized milk facility, Enterobacteriaceae are consistently found in the final product. However, coliform tests are negative. What does this indicate?
(A) The milk heat treatment temperature profile during pasteurization is set too high.
(B) Presence of non-coliform Enterobacteriaceae indicates post-treatment hygiene failure.
(C) The finished pasteurized milk product is completely free of all biological risks.
(D) Enterobacteriaceae are naturally occurring, heat-resistant bacterial spore formers.

29. Which of the following microorganisms is NOT classified as a member of the coliform group?
(A) Staphylococcus aureus
(B) Escherichia coli
(C) Citrobacter freundii
(D) Klebsiella pneumoniae

30. During microbiological examination, E. coli is detected in a sample of ready-to-eat salad at a level exceeding regulatory limits. As a Food Safety Officer, what is the most appropriate regulatory action?
(A) Recommend that the production facility increase the total sodium chloride level of the salad.
(B) Permit the raw product to remain on retail shelves since E. coli is normal flora of all plants.
(C) Order a recall due to faecal contamination

46. Which standardized pore size is most commonly used in the membrane filtration method for water quality testing to trap coliform bacteria?
(A) $0.10\mu m$
(B) $0.45\mu m$
(C) $1.20\mu m$
(D) $5.00\mu m$

47. Consider the following statements about the membrane filtration (MF) method for water testing:
I. It allows for the processing of large volumes of water.
II. It isolates discrete colonies, allowing for a direct count of target microorganisms.
III. It is highly suitable for waters with high turbidity and high suspended solids.
IV. Organisms retained on the filter are cultured by placing the filter onto a suitable agar medium or broth-soaked pad.
Which of the above statements are correct?
(A) I, II, and III only
(B) I, II, and IV only
(C) II, III, and IV only
(D) I, III, and IV only

48. How is EC broth defined in the context of confirmatory tests for faecal coliforms?
(A) A non-selective general-purpose growth broth formulated specifically to estimate the total aerobic plate count.
(B) A diagnostic solid agar medium containing indicator dyes used to differentiate lactose fermenters by colony color.
(C) A selective bile-salt medium incubated at elevated temperatures to detect E. coli and faecal coliforms.
(D) A highly nutrient-rich pre-enrichment broth designed specifically to support damaged Salmonella cell resuscitation.

49. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The membrane filtration technique is often preferred over the MPN method for testing treated municipal drinking water.
Reason (R): Treated municipal drinking water has very low turbidity and low bacterial counts, making it ideal for filtering large volumes to detect sparse contaminants.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

50. Which of the following statements correctly describes a confirmatory test using EC broth?
(A) EC broth is poured directly onto a solid food sample and then incubated under fully aerobic ambient conditions.
(B) A positive test reaction is visually indicated by the rapid formation of a bright red surface ring after adding Kovac's reagent.
(C) EC broth tests require a prolonged incubation time of exactly seven calendar days to confirm target faecal coliform presence.
(D) Inoculate EC broth from positive presumptive tubes and incubate at 44.5°C for 24 hours.

51. Match List I with List II:
List I: (Membrane Filtration Media/Indicator)
P. m-Endo medium
Q. m-FC medium
R. Rosolic acid in m-FC
S. Metallic sheen
List II: (Target Organism / Colony Appearance)
I. Inhibits non-faecal coliform background flora
II. Typical appearance of Total Coliforms on m-Endo
III. Used for Total Coliforms
IV. Used for Faecal Coliforms (yields blue colonies)
(A) P-III, Q-IV, R-I, S-II
(B) P-III, Q-I, R-IV, S-II
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-IV, R-I, S-III

52. Which of the following statements is incorrect regarding the membrane filtration method?
(A) It provides results significantly faster than the traditional completed MPN method.
(B) Toxic substances present in the water sample may concentrate on the filter and inhibit bacterial growth.
(C) It is the method of choice for testing heavy sludge and highly turbid wastewater.
(D) It permits the easy transfer of the membrane to different media for confirmatory testing.

53. The correct sequence of steps for Salmonella detection in food samples is:
(A) Pre-enrichment → Selective enrichment →

Downloaded from www.pdf.tube

38. A water sample is subjected to the MPN test using a 3-tube series with volumes of 10 mL, 1 mL, and 0.1 mL. The number of positive tubes in the confirmed test is 3, 2, and 1, respectively. According to a standard 3-tube MPN table, this index corresponds to an MPN of $150/100mL$. What causes a higher MPN index like 3-3-3?
(A) Significant reduction in the overall concentration of competitive background microflora.
(B) Severe physiological inhibition of the target indicator organism by residual chlorine.
(C) A major systematic error occurring during the preparation of the dehydrated growth media.
(D) A high concentration of target organisms resulting in positive growth across all dilutions.

39. Given below are two statements:
Statement I: In the MPN presumptive test for coliforms, the presence of an inverted Durham tube is required to capture gas.
Statement II: Gas production within 24 to 48 hours indicates a definitively negative result for coliforms.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

40. Which of the following pairs is correctly matched regarding MPN methodology?
(A) Lauryl Sulfate Tryptose (LST) Broth — Supports growth of Gram-positive bacteria
(B) Durham tube — Used to measure changes in pH
(C) Brilliant Green dye — Inhibits Gram-positive bacteria and non-coliforms
(D) MPN Table — Provides a standard deviation for plate counts

41. Why might a microbiologist choose the MPN method over the Membrane Filtration (MF) method for analyzing river water for coliforms?
(A) The MPN procedure provides rapid biochemical results within a short two-hour window.
(B) The analyzed surface water sample is extremely clear with very low background bacteria.
(C) Membrane filtration membranes are physically incapable of trapping Gram-negative bacilli.
(D) The water sample contains high levels of suspended particulate matter and turbidity.

42. Which of the following pairs concerning the MPN presumptive test is incorrectly matched?
(A) Indicator organism detected — Obligate anaerobes
(B) Positive result — Turbidity and gas formation
(C) Media used — MacConkey broth or LST broth
(D) Incubation temperature — Typically $35^{\circ}C - 37^{\circ}C$

43. A technician sets up a 5-tube MPN test with dilutions 10^{-1}, 10^{-2}, and 10^{-3}. The tube results are 5-0-0. What does this specific combination most likely signify regarding the microbial load?
(A) The sample's microbial load is exceptionally high, completely exceeding the test detection limits.
(B) The microbial load is moderate and primarily detectable at the lowest dilution (10^{-1}).
(C) The analyzed food or water sample is completely sterile and devoid of any viable organism.
(D) The formulated chemical diluent was highly toxic and lethal to the target bacterial population.

44. Which of the following is NOT an advantage of the Most Probable Number (MPN) technique?
(A) It can be highly effective for samples containing high organic matter or turbidity.
(B) It provides a direct, highly precise actual count of the target microbes.
(C) It can be used to recover stressed or sublethally injured cells effectively via liquid broth enrichment.
(D) It is easily adaptable for different selective media for various pathogens.

45. You are interpreting a 3-tube MPN series using sample inoculums of 0.1 g, 0.01 g, and 0.001 g. The positive tube combination is 3-1-0. The MPN table value for 3-1-0 (based on 10, 1, 0.1 inocula) is 43. What is the correct MPN per gram for your sample?
(A) 4.3
(B) 43
(C) 430
(D) 4300

NODIA

positive for Salmonella. What is the competent decision based on the guidelines?
(A) The entire batch must be rejected as it fails the Food Safety Criteria.
(B) The batch can be accepted if it is re-pasteurized at a higher temperature.
(C) Only the single positive sample unit is discarded while the rest are sold.
(D) The positive result is ignored if the other four samples are fully negative.

91. Which international standard is universally adopted for the general requirements for the competence of testing and calibration laboratories, including food microbiology laboratories?
(A) ISO 9001
(B) ISO/IEC 17025
(C) ISO 22000
(D) ISO 14001

92. Consider the following statements regarding quality control (QC) in microbiological media preparation:
I. Each new batch of media must be tested for sterility.
II. The ability of the media to support the growth of target organisms must be verified using positive reference cultures.
III. The inhibitory properties of selective media must be verified using non-target (negative) reference cultures.
IV. Media can be stored indefinitely as long as it is kept at 4°C.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and IV only

93. In a microbiological laboratory, how is "measurement uncertainty" best defined?
(A) A parameter characterizing dispersion of values attributed to a measurand.
(B) The cumulative number of personal mistakes made by a laboratory technician during a testing run.
(C) The absolute mathematical degree of confidence that a target pathogen is absent from the sample.
(D) The systematic, intentional alteration of raw analytical findings to fit acceptable compliance ranges.

94. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Proficiency testing (PT) is a mandatory requirement for accredited microbiological testing laboratories.
Reason (R): PT provides an independent assessment of a laboratory's competence by comparing its results against those of other participating laboratories using unknown samples.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

95. Which of the following statements correctly describes the use of reference cultures in a food microbiology laboratory?
(A) They represent unknown, wild-type bacterial strains isolated directly from food samples during routine testing operations.
(B) They are specialized strains utilized strictly to artificially contaminate commercial food products prior to retail sale.
(C) They are uncharacterized wild strains maintained in simple sterile water suspensions for long-term laboratory storage.
(D) They are authenticated strains of known characteristics used to verify media and reagent performance.

96. Match List I with List II:
List I: (Quality Control Term)
P. Certified Reference Material (CRM)
Q. Proficiency Testing (PT)
R. Internal Quality Control (IQC)
S. Traceability
List II: (Explanation)
I. Routine checks (e.g., blanks, duplicates) performed within the lab
II. Inter-laboratory comparison to assess performance
III. Unbroken chain of calibrations relating a result to a standard
IV. Material characterized by a metrologically valid procedure for one or more properties
(A) P-IV, Q-II, R-I, S-III
(B) P-II, Q-IV, R-I, S-III
(C) P-IV, Q-I, R-II, S-III
(D) P-III, Q-II, R-I, S-IV

Click Here to Buy book on Amazon

Plating on selective agar → Biochemical confirmation
(B) Selective enrichment → Pre-enrichment → Plating on selective agar → Biochemical confirmation
(C) Plating on selective agar → Pre-enrichment → Biochemical confirmation → Selective enrichment
(D) Biochemical confirmation → Plating on selective agar → Pre-enrichment → Selective enrichment

54. Given below are two statements:
Statement I: Pre-enrichment in Salmonella testing uses a non-selective medium like Buffered Peptone Water (BPW).
Statement II: The purpose of pre-enrichment is to suppress the growth of competitive background microflora immediately.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

55. Which of the following pairs concerning Salmonella detection is correctly matched?
(A) Pre-enrichment — Rappaport-Vassiliadis (RV) broth
(B) Selective enrichment — Tetrathionate (TT) broth
(C) Selective plating — Buffered Peptone Water (BPW)
(D) Confirmation — Xylose Lysine Deoxycholate (XLD) agar

56. A food microbiologist is testing a heavily processed milk powder for Salmonella. Why is the pre-enrichment step absolutely critical in this analysis?
(A) To selectively kill competitive Gram-positive bacteria and background microflora before they begin to sporulate.
(B) To physically concentrate the dissolved milk powder suspension into a much smaller, highly workable volume.
(C) To allow sub-lethally injured Salmonella cells to repair and multiply.
(D) To directly precipitate target Salmonella protein toxins from the food matrix for rapid ELISA detection.

57. Which of the following pairs regarding Salmonella selective agar appearance is incorrectly matched?
(A) Xylose Lysine Deoxycholate (XLD) Agar — Red colonies with black centers
(B) Bismuth Sulfite Agar (BSA) — Brown, gray, or black colonies sometimes with a metallic sheen
(C) Hektoen Enteric (HE) Agar — Blue-green colonies with black centers
(D) MacConkey Agar — Brilliant green colonies with a distinct white halo

58. A laboratory isolated a suspect colony from XLD agar during a Salmonella test. Upon inoculating a Triple Sugar Iron (TSI) agar slant, the result after 24 hours shows an alkaline (red) slant, an acid (yellow) butt, and blackening of the medium. What does this indicate?
(A) Typical Salmonella biochemical reactions (glucose fermentation and H_2S production).
(B) The isolated organism is definitely a classic strain of Escherichia coli.
(C) The bacterial isolate ferments lactose completely but fails to produce hydrogen sulfide gas.
(D) The analyzed colony represents a strictly aerobic, non-fermenting Pseudomonas species.

59. Which of the following is NOT a biochemical characteristic typically used to confirm Salmonella isolates?
(A) Hydrogen sulfide production (Positive)
(B) Urease production (Positive)
(C) Lysine decarboxylase (Positive)
(D) Indole test (Negative)

60. You are performing an analysis to identify Salmonella. You have completed the pre-enrichment and selective enrichment phases. What is your primary objective when streaking the culture onto XLD and BSA plates?
(A) To systematically enumerate the total aerobic mesophilic bacterial count of the sample.
(B) To isolate discrete colonies for biochemical and serological confirmation.
(C) To accurately determine the precise thermal death time and kinetic parameters of the strain.
(D) To directly extract pure, high-quality bacterial DNA templates for PCR amplification steps.

Downloaded from www.pdf.tube

61. Which specific component in Baird-Parker agar makes it selective for Staphylococcus aureus?
(A) Lithium chloride paired with potassium tellurite
(B) Lactose monohydrate combined with neutral red indicator
(C) Purified bile salts mixed with brilliant green dye
(D) High-purity sodium chloride and phenol red indicator

62. Consider the following statements about Staphylococcus aureus and its enumeration:
I. S. aureus is a Gram-positive, coagulase-positive coccus.
II. On Baird-Parker agar, typical S. aureus colonies are black and surrounded by a clear zone.
III. The clear zone on Baird-Parker agar is due to proteolytic degradation of beef extract.
IV. S. aureus enterotoxins are highly heat-resistant and can cause food poisoning even if the live bacteria are destroyed.
Which of the above statements are correct?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

63. What is the definition of a positive coagulase test, a key confirmatory test for Staphylococcus aureus?
(A) The production of gas bubbles when hydrogen peroxide is added to a bacterial colony
(B) The color change of a pH indicator from red to yellow due to mannitol fermentation
(C) The visual clearing of a sterile egg yolk emulsion incorporated into an agar plate
(D) Clotting of rabbit plasma by the bacterial coagulase enzyme

64. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Listeria monocytogenes testing in foods often incorporates a "cold enrichment" step or uses selective enrichment broths incubated for extended periods.
Reason (R): Listeria monocytogenes is a psychrotrophic pathogen that can grow at refrigeration temperatures, and enrichment helps it outgrow competitive mesophilic flora.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

65. Which of the following statements correctly characterizes Listeria monocytogenes?
(A) It is a Gram-negative, spore-forming bacillus that causes major waterborne disease outbreaks.
(B) It exhibits distinct umbrella-like motility in semi-solid agar at 20°C - 25°C.
(C) It is highly susceptible to acidic conditions and cannot survive at refrigeration temperatures.
(D) It produces heat-stable enterotoxins that are fully resistant to standard commercial pasteurization.

66. Match List I with List II:
List I: (Pathogen)
P. Staphylococcus aureus
Q. Listeria monocytogenes
R. Escherichia coli
S. Salmonella spp.
List II: (Key Isolation/Detection Medium)
I. Eosin Methylene Blue (EMB) agar
II. Baird-Parker (BP) agar
III. Xylose Lysine Deoxycholate (XLD) agar
IV. PALCAM or ALOA agar
(A) P-II, Q-IV, R-I, S-III
(B) P-IV, Q-II, R-I, S-III
(C) P-II, Q-IV, R-III, S-I
(D) P-I, Q-IV, R-II, S-III

67. Which of the following statements is incorrect regarding the function of egg yolk tellurite emulsion in Baird-Parker agar?
(A) The tellurite provides vital growth factors to accelerate the replication rate of S. aureus.
(B) The tellurite is selectively reduced by S. aureus to free tellurium, coloring the colonies black.
(C) The egg yolk lipid fraction serves as a specific substrate used to detect active lecithinase.
(D) The egg yolk detects lipase enzymatic activity, creating a distinct opaque zone inside the clear zone.

68. Severe sub-lethal stress to foodborne pathogens (such as freezing, heating, or low pH) leads to a

NODIA

specific procedural necessity in microbiological examination. Which of the following is the direct effect of this stress?
(A) The stressed pathogen cells immediately transition to obligate anaerobic metabolic pathways.
(B) Stressed cells permanently lose their genomic markers and cannot be identified by target PCR assays.
(C) A pre-enrichment step is required to allow cell repair before selective agent exposure.
(D) Stressed pathogens begin multiplying logarithmically without showing any normal initial lag phase.

69. Given below are two statements:
Statement I: Staphylococcus aureus is notable for its halotolerance, meaning it can grow at low water activities and high salt concentrations.
Statement II: Because of its halotolerance, S. aureus is never outcompeted by other bacteria in fresh, high-moisture foods like raw meat.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

70. Which of the following pairs regarding the differentiation of Listeria species is correctly matched?
(A) L. innocua — Strongly β-hemolytic on sheep blood agar
(B) L. ivanovii — Non-hemolytic on sheep blood agar
(C) CAMP test — Used to detect lactose fermentation in Listeria
(D) L. monocytogenes — β-hemolytic on sheep blood agar

71. A batch of ready-to-eat deli meats was recalled due to Listeria monocytogenes contamination. The product was properly pasteurized during manufacture. What is the most likely concept explaining its presence in the final product?
(A) Bacterial spore survival during the high-temperature pasteurization process.
(B) Environmental cross-contamination after pasteurization but before packaging.
(C) Spontaneous development of Listeria populations inside anaerobic vacuum packaging.
(D) Incomplete biochemical breakdown of added organic and natural chemical preservatives.

72. Which of the following pairs regarding Staphylococcus aureus testing is incorrectly matched?
(A) Catalase test — Positive
(B) Gram stain — Gram-positive cocci in clusters
(C) Coagulase test — Negative
(D) Thermonuclease test — Positive

73. A foodborne illness outbreak is linked to a creamy pastry. The laboratory detects high levels of S. aureus enterotoxin in the pastry, but culture methods fail to yield any viable S. aureus cells. What is the most plausible explanation for this case?
(A) The viable S. aureus cells underwent a rapid, high-frequency genetic mutation into an entirely different genus.
(B) The laboratory technician inadvertently utilized an extremely toxic pre-enrichment broth that killed all cells.
(C) Staphylococcal enterotoxins can spontaneously assemble in high-lipid food matrices without any bacterial cells.
(D) S. aureus produced heat-stable toxin, and later heating killed vegetative cells without destroying the toxin.

74. Which of the following is NOT a typical feature of Listeria monocytogenes grown on PALCAM agar?
(A) Rapid hydrogen sulfide production causing a totally black plate in 4 hours.
(B) Positive hydrolysis of esculin, which is a key diagnostic feature of the Listeria genus.
(C) Formation of a distinct, dark black diffusion halo surrounding the growing colonies.
(D) Typical development of small, diagnostic olive-green to black colored colonies on the agar.

75. An analyst conducts a coagulase test on a suspected S. aureus isolate using rabbit plasma. After 4 hours of incubation at 37°C, a firm clot is observed in the tube. By 24 hours, the clot has dissolved and the plasma is liquid again. How should the analyst interpret this?
(A) The test is negative; any clot that liquefies within 24 hours must be interpreted as a false-positive result.
(B) The test is positive; the later liquefaction is likely due to staphylokinase activity destroying the clot.

Click Here to Buy book on Amazon

risks and possible enteric pathogens.
(D) Instruct the plant manager to resample and average the findings to achieve safety compliance.

31. Which statistical distribution forms the fundamental basis of the Most Probable Number (MPN) method?
(A) Normal distribution
(B) Binomial distribution
(C) Exponential distribution
(D) Poisson distribution

32. Consider the following statements about the MPN method:
I. It is an estimation method, not an absolute count of microbial cells.
II. It is particularly useful for samples with high particulate matter that interfere with standard plate counts.
III. It relies on inoculating multiple tubes at successive decimal dilutions.
IV. It only detects dead microbial cells.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and IV only

33. How is the "Most Probable Number (MPN)" best defined?
(A) The absolute, direct count of discrete bacterial colonies growing on a selective membrane filter.
(B) A statistical estimate of viable cell concentration based on positive and negative tube patterns.
(C) The highest serial dilution factor at which no macroscopic microbial growth is visually observed.
(D) The legally mandated maximum allowable concentration limit of target pathogens in a food matrix.

34. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The MPN completed test is required to definitively prove that the gas produced in earlier tests is due to coliform bacteria.
Reason (R): Some non-coliform organisms, acting synergistically, can produce gas in lactose broth during the presumptive test.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

35. Which of the following statements correctly describes the confirmed test for coliforms in the MPN method?
(A) It inoculates positive presumptive tubes into Brilliant Green Bile (BGLB) broth.
(B) It involves incubating samples at 55°C to selectively suppress background thermophilic growth.
(C) It relies on performing a rapid Gram stain directly from the raw untreated water sample.
(D) It confirms coliform presence by measuring hydrogen sulfide gas production on standard TSI agar.

36. Match List I with List II:
List I: (MPN Test Stage)
P. Presumptive Test
Q. Confirmed Test
R. Completed Test
S. Faecal Coliform Test
List II: (Characteristic feature / Medium)
I. EC Broth at 44.5°C
II. Lauryl Tryptose Broth (LST) or MacConkey broth
III. Brilliant Green Bile Broth (BGLB)
IV. Eosin Methylene Blue (EMB) agar and Gram stain
(A) P-II, Q-III, R-IV, S-I
(B) P-III, Q-II, R-IV, S-I
(C) P-II, Q-IV, R-III, S-I
(D) P-IV, Q-III, R-II, S-I

37. Which of the following statements about interpreting MPN tables is incorrect?
(A) An MPN value provides the exact, absolute number of bacterial cells in the sample.
(B) MPN values are usually reported as organisms per 100 mL or 1 g.
(C) The standard tables typically assume a 3-tube or 5-tube series at decimal dilutions.
(D) The combination of positive tubes (e.g., 3-2-1) is used as an index to read the MPN table.

(A) They provide a comprehensive scientific framework to evaluate the overall safety and quality of any given food batch.
(B) They differentiate strictly between foods intended for the general public and foods targeted at vulnerable populations.
(C) They employ a highly structured statistical sampling approach using standardized two-class or three-class plans.
(D) They dictate that all raw agricultural commodities must have a total aerobic plate count of zero before retail sale.

83. When faecal contamination occurs in a municipal water supply, what is the direct consequence regarding microbiological indicators?
(A) An immediate spike in E. coli and faecal streptococci levels.
(B) The total and rapid elimination of all background aerobic bacteria.
(C) A drastic, measurable decrease in the overall biological oxygen demand.
(D) The spontaneous chemical precipitation of heavy metals within the water.

84. Given below are two statements:
Statement I: Under FSSAI guidelines, Food Safety Criteria define the acceptability of a product or a batch of foodstuff applicable to products placed on the market.
Statement II: Process Hygiene Criteria define the acceptable functioning of the production process and are not necessarily used to assess the safety of a product already on the market.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

85. Which of the following pairs regarding water testing parameters is correctly matched?
(A) E. coli — Indicator of recent faecal contamination
(B) Total Coliforms — Proof of viral contamination
(C) Heterotrophic Plate Count (HPC) — Specific count of pathogenic protozoa
(D) F-specific RNA bacteriophages — Indicators of heavy metal toxicity

86. A food safety officer reviews laboratory results for a batch of cooked shrimp. The FSSAI limits for S. aureus are n=5, c=1, $m = 10^2$, $M = 10^3$. The test results (in CFU/g) are: 50, 80, 200, 90, 150. How should the officer apply the concept of this compliance plan?
(A) Accept the batch because all individual sample values are strictly below the maximum limit 'M'.
(B) Accept the batch because the mathematical average of the five samples remains below the limit of 10^2.
(C) Reject the batch because the highest single recorded value is 200, which is double the baseline 'm' limit.
(D) Reject the batch because two samples exceed 'm', which is more than 'c'.

87. Which of the following pairs is incorrectly matched according to general microbiological water standards (IS 10500)?
(A) E. coli in drinking water — $0/100mL$
(B) Sulphite-reducing anaerobes — Allowed up to $50/100mL$
(C) Coliforms in treated water entering distribution — $0/100mL$
(D) Sample volume for E. coli detection — 100 mL

88. A municipality tests its drinking water supply at the distribution endpoint. The laboratory reports the presence of total coliforms (MPN of $4/100mL$) but absence of E. coli. What does this specific case indicate?
(A) The water supply has been contaminated with fresh, untreated municipal sewage.
(B) The treatment facility plant operator added an excessively high dose of residual chlorine.
(C) Likely distribution system integrity failure, but not necessarily fresh faecal pollution.
(D) The sample is completely safe for consumption and complies fully with IS 10500 guidelines.

89. Which of the following is NOT a recognized microbiological parameter standard evaluated for packaged drinking water under FSSAI regulations?
(A) Yeast and Mould count
(B) Vibrio cholerae
(C) Aerobic Plate Count at 20°C and 37°C
(D) Total lipid oxidation level

90. Under FSSAI regulations, a dairy plant tests a batch of pasteurized milk for Salmonella ($n = 5, c = 0$). One sample out of five tests

Downloaded from www.pdf.tube

(C) The test is invalid; the liquefaction indicates that the rabbit plasma used was contaminated with other bacteria.
(D) The test is negative; a true positive staphylococcal coagulase reaction must remain completely solid indefinitely.

76. According to the Bureau of Indian Standards (IS 10500) for drinking water, what is the acceptable limit for E. coli or thermotolerant coliform bacteria in any 100 mL sample?
(A) A maximum concentration not exceeding ten organisms per 100 mL volume
(B) A maximum concentration not exceeding five organisms per 100 mL volume
(C) A maximum concentration not exceeding one organism per 100 mL volume
(D) Shall not be detectable in any analyzed 100 mL sample volume

77. Consider the following statements about FSSAI microbiological standards for processed foods:
I. FSSAI specifies standards in terms of 'n', 'c', 'm', and 'M'.
II. Food Safety Criteria usually focus on severe pathogens like Salmonella and L. monocytogenes.
III. Process Hygiene Criteria primarily utilize indicator organisms like Aerobic Plate Count (APC) and Coliforms.
IV. Failure to meet Process Hygiene Criteria always results in an immediate, mandatory national recall of the food product.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and IV only

78. What does "Aerobic Plate Count (APC)" define in the context of food microbiological standards?
(A) Total concentration of viable anaerobic pathogenic microorganisms present in a standard food sample.
(B) The specific concentration of viable and culturable Escherichia coli strains inside a finished product.
(C) Estimation of the total viable aerobic population, reflecting general quality.
(D) Total number of bacterial vegetative cells that survive standardized high-temperature pasteurization.

79. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): In IS 10500 standards, the total coliform count in piped drinking water entering the distribution system must be zero per 100 mL.
Reason (R): Total coliforms are highly pathogenic and ingestion of a single cell causes severe gastrointestinal disease.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

80. Which of the following statements correctly states a requirement under the IS 10500 standards for drinking water quality?
(A) Coliform bacteria are allowed at concentrations up to 50 organisms per 100 mL in distribution systems.
(B) The presence of any viruses is completely acceptable if turbidity remains below one nephelometric unit.
(C) E. coli must not be detectable in any 100 mL sample.
(D) Total coliform bacteria can be present in up to 10% of piped water samples tested throughout a month.

81. Match List I with List II:
List I: (FSSAI Food Category Focus)
P. Pasteurized milk
Q. Infant milk substitute
R. Packaged drinking water
S. Raw meat
List II: (Typical Stringent Standard Parameter)
I. Salmonella / Cronobacter sakazakii (c=0)
II. Aerobic Plate Count and Coliform count (Process indicators)
III. Total coliforms, E. coli, and Pathogens must be absent
IV. High baseline APC acceptable; focus on pathogens like Salmonella
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-III, Q-IV, R-I, S-II
(D) P-II, Q-III, R-I, S-IV

82. Which of the following statements is incorrect regarding the application of FSSAI microbiological criteria?

NODIA

97. Which of the following statements is incorrect regarding the calibration of laboratory equipment?
(A) Autoclaves must be regularly calibrated to ensure they reach the required sterilization temperature.
(B) Calibration certificates for critical equipment are optional under ISO/IEC 17025.
(C) Pipettes and volumetric glassware require periodic calibration to ensure accurate dispensing of volumes.
(D) Incubator temperatures should be monitored and recorded daily.

98. When an autoclave fails to reach the required sterilization temperature of 121°C during media preparation, what is the direct effect on the laboratory's testing process?
(A) The growth media undergoes chemical degradation, becoming excessively acidic and unusable.
(B) The structural integrity of the agar is destroyed, causing a permanent loss of solidifying ability.
(C) The prepared media will selectively kill all target pathogens due to chemical toxic byproduct buildup.
(D) Surviving bacterial spores can germinate, causing false-positive contamination results.

99. Given below are two statements:
Statement I: A positive control involves running a test with a known target organism to ensure the method and media can successfully detect it.
Statement II: A negative control is only necessary when testing for viral pathogens, not for bacterial indicators.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

100. Which of the following pairs regarding equipment and its specific calibration/verification parameter is correctly matched?
(A) Analytical Balance — Standardized high-purity chemical pH buffer solutions
(B) pH meter — Traceable calibrated metal weight sets of known mass
(C) Autoclave — Biological indicators like Geobacillus spores
(D) Bio-safety cabinet — Multipoint thermocouple temperature profiling validation

101. A laboratory participates in a Proficiency Testing (PT) round for Salmonella detection and reports a "Negative" result for a sample that the PT provider spiked with Salmonella. In applying the concept of Root Cause Analysis, what is the most appropriate first step?
(A) Review media logs, control results, and methodology for that specific test run.
(B) Terminate the employment contract of the laboratory technician who performed the analysis.
(C) Disregard the PT report entirely, assuming the provider distributed damaged or flawed samples.
(D) Completely rewrite the laboratory's standard operating procedures for all pathogen testing.

102. Which of the following pairs related to statistical aspects of microbiological testing is incorrectly matched?
(A) Repeatability — The closeness of agreement between results under identical operating conditions
(B) Reproducibility — Closeness of agreement between results under changed measurement conditions
(C) False Positive Rate — The probability of a negative sample yielding a positive test result
(D) Limit of Detection (LOD) — The maximum concentration of microbes a method can accurately quantify

103. A technician sets up daily QC checks for an Aerobic Plate Count analysis. After 48 hours of incubation, the 'diluent blank' (which should contain only sterile peptone water) shows 15 bacterial colonies. What should the analyst do in this case?
(A) Mathematically subtract 15 colonies from all tested sample plate counts to correct for the background error.
(B) Invalidate results, investigate contamination, and repeat all tests.
(C) Report the sample findings exactly as they are, treating 15 background colonies as a statistically negligible load.
(D) Re-incubate the blank plate for an additional 48 hours to observe if any more colony forming units emerge.

Click Here to Buy book on Amazon

117. Which of the following pairs regarding reporting terminology is incorrectly matched?
(A) MPN — Minimum Pathogen Number
(B) CFU — Colony Forming Unit
(C) ND — Not Detected
(D) TNTC — Too Numerous To Count

118. A food processor receives a rapid PCR test indicating "Positive" for Listeria in a food matrix. However, the regulatory cultural confirmation test takes 5 days and eventually returns "Negative." Assuming both tests were performed flawlessly without contamination, how is this discrepancy best explained in a case analysis?
(A) The traditional cultural isolation method has a significantly lower limit of detection and higher sensitivity than PCR assays.
(B) The rapid PCR screening test is fundamentally unstable and randomly generates false-positive results in half of the runs.
(C) Viable Listeria monocytogenes cells actively degrade their genomic DNA upon heating to evade standard PCR detection limits.
(D) PCR detected DNA from dead cells, while the cultural method only detects viable, culturable cells.

119. Which of the following is NOT a valid reason for a laboratory manager to authorize the re-testing of a food sample?
(A) The inoculated positive reference control strain failed to show any viable growth during the analytical run.
(B) The commercial client dislikes the final result because it means their product batch will be legally rejected.
(C) The calibrated laboratory incubator malfunctioned, dropping to 20°C during the critical 37°C incubation period.
(D) A routine internal quality control check revealed that the sterile diluent blank used was heavily contaminated.

120. A quality auditor discovers that a laboratory has repeatedly failed to document the incubation times and temperatures for its coliform testing over the past month. As a competent Food Safety Officer, how do you categorize and act upon this finding?
(A) Issue a simple verbal warning during the closing meeting since the final sample results were all reported as negative.
(B) Ignore the finding entirely, treating time and temperature documentation as optional suggestions under ISO 17025 rules.
(C) File a major non-conformity report because undocumented incubation parameters invalidate the testing results.
(D) Assume that the laboratory technicians correctly memorized all the incubation times and formally close the audit file.

121. The MUG test used to quickly detect E. coli in water and food samples targets which specific enzyme?
(A) β-galactosidase
(B) Cytochrome oxidase
(C) Catalase
(D) β-glucuronidase

122. Consider the following statements about microbial survival and recovery:
I. Sub-lethally injured cells are highly sensitive to selective agents like salts or dyes that healthy cells easily tolerate.
II. The VBNC state is commonly induced by environmental stresses such as extreme temperature, starvation, or chlorination.
III. Pathogens in a VBNC state cannot be resuscitated under any known circumstances.
IV. Rich, non-selective media are generally used in pre-enrichment to overcome sub-lethal injury.
Which of the above statements are correct?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

123. What is the definition of "Proficiency Testing (PT)" in the context of laboratory quality assurance?
(A) The daily internal calibration of analytical balances using standardized metal weight sets.
(B) Assessing lab performance against set criteria using inter-laboratory comparisons.
(C) The systematic daily cleaning, sanitization, and environmental monitoring of laboratory spaces.
(D) A formal, mandatory oral and practical examination administered to all testing staff annually.

NODIA

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

integer count to formally indicate complete sample sterility.
(C) Report as "less than 1 times the lowest dilution factor" (e.g., $< 10 CFU/g$).
(D) The testing run must be completely discarded as a laboratory protocol failure and immediately repeated from the beginning.

111. Match List I with List II:
List I: (Documentation Type)
P. Standard Operating Procedure (SOP)
Q. Equipment Logbook
R. Certificate of Analysis (CoA)
S. Quality Manual
List II: (Purpose)
I. The final reported document containing test results and compliance status
II. Step-by-step instructions on how to perform a specific test
III. Overarching document detailing the laboratory's quality management system
IV. Record of maintenance, calibration, and usage history of a machine
(A) P-II, Q-IV, R-I, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-IV, R-I, S-II

112. Which of the following statements is incorrect regarding the contents of a formal microbiological test report?
(A) It must clearly and uniquely identify the food sample, including all batch numbers, manufacturer details, and dates of receipt.
(B) It must explicitly specify the exact standardized reference test method utilized during the analysis (e.g., ISO, IS, or FDA-BAM).
(C) It must include the analyst's personal home address and private telephone number.
(D) It must state the final analytical units of measurement clearly and unambiguously (e.g., CFU/g or MPN/100 mL of sample).

113. When bacterial cells in food are subjected to sub-lethal injury (e.g., mild heat, freezing, or sanitizer exposure), what is the direct effect on their growth kinetics during laboratory isolation?
(A) They completely bypass the initial lag phase, instantly entering the active exponential log phase of replication.
(B) They exhibit an extended lag phase while repairing cellular structures before division.
(C) They immediately undergo protective cellular sporulation, regardless of whether the species is a spore-former.
(D) They permanently and irreversibly lose all their virulence factors and associated environmental pathogenicity.

114. Given below are two statements:
Statement I: Solid foods like ground meat or powdered milk typically have a highly uniform and homogeneous distribution of contaminating microorganisms.
Statement II: Because of this uniform distribution, testing a single 1-gram sample is statistically sufficient to represent a 10-ton batch.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

NODIA

115. Which of the following pairs regarding interpretation challenges and their impact is correctly matched?
(A) Presence of high background microflora — Overgrowth on agar plates obscuring target pathogen colonies
(B) VBNC state — Spontaneous genetic mutations rendering standard PCR primers completely non-functional
(C) High fat content — Direct chemical destruction of target bacterial cell walls during homogenization
(D) Sub-lethal injury — Immediate and permanent loss of all biochemical traits used for confirmation

116. A raw milk sample suspected of containing sublethally injured E. coli cells is submitted for testing. Applying correct microbiological concepts, which technique will best facilitate their recovery and accurate enumeration?
(A) Inoculating the raw milk sample directly onto highly selective growth media such as Violet Red Bile Agar plates.
(B) Introducing low concentrations of toxic heavy metals into the sample matrix to biochemically force rapid division.
(C) Resuscitation in a non-selective broth at room temperature before selective plating.
(D) Spreading the sample onto agar plates and incubating at 50°C to thermally shock the cells into rapid growth.

to a lactose broth with a Durham tube, and performing a Gram stain on a slant culture.
Statement II: A positive completed test must show gas production in the lactose broth and reveal Gram-negative, non-spore-forming rods.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

145. Which of the following pairs is correctly matched regarding sample transport for microbiological testing?
(A) Frozen foods — Must be completely thawed at ambient room temperature during transit to the laboratory.
(B) Perishable unfrozen foods — Transported rapidly at $0^{\circ}C - 4^{\circ}C$.
(C) Canned foods — Must be packed in solid dry ice blocks to maintain an extremely low storage temperature.
(D) Water samples — May be kept at warm ambient temperatures of 30°C for up to one week prior to analysis.

146. A new brand of packaged drinking water is being tested for FSSAI compliance. The lab tests 250 mL using membrane filtration and counts 3 distinct colonies of Escherichia coli. Applying FSSAI and IS 10500 concepts, what is the compliance status?
(A) Compliant, because the regulatory standard threshold is set below 10 CFU per 250 mL volume.
(B) Compliant, because membrane filtration of drinking water frequently yields false-positive colonial growth.
(C) Non-compliant, but only in specific scenarios where the growing bacterial colonies are heavily pigmented.
(D) Non-compliant, because E. coli must be completely absent in the sample volume.

147. Which of the following pairs regarding laboratory documentation is incorrectly matched?
(A) Method Validation — Verifying that an instrument is clean
(B) Raw Data — Original observations recorded during testing
(C) Audit Trail — Chronological record of who did what and when
(D) Deviation — A departure from the documented standard operating procedure

148. A regulatory audit is conducted in a food testing lab. The auditor reviews the testing file for a batch of high-risk infant formula tested for Salmonella. The lab reports "Absent in 25 g". However, the raw data shows that the positive control (a known Salmonella strain) inoculated into BPW did not grow on the XLD agar. What is the impact on the case?
(A) The test result remains perfectly valid because the actual infant formula food sample itself tested negative.
(B) The analytical test is valid because utilizing positive controls is merely recommended rather than mandatory.
(C) Invalid, because failed positive controls indicate systemic testing or media failure.
(D) The auditor should assume the positive control strain was simply dormant and formally pass the laboratory.

149. Which of the following is NOT a consequence of poor laboratory layout where the sample receipt area is located directly next to the pathogen incubation and isolation area?
(A) Improved measurement uncertainty calculations
(B) Increased risk of cross-contamination from pathogen cultures to incoming raw samples
(C) Potential for false-positive test results
(D) Compromise of the integrity of the environmental monitoring program

150. Based on your overall competency in FSSAI microbiological guidelines and laboratory practices, what is the fundamental purpose of distinguishing between 'm' and 'M' in a three-class sampling plan?
(A) To provide a strict, unyielding absolute cutoff limit where any trace microbial presence triggers immediate legal prosecution.
(B) To allow commercial food processors to perpetually manufacture and sell highly contaminated food batches without any consequence.
(C) To deliberately complicate the underlying mathematical and statistical models utilized by accredited food testing laboratories.
(D) To define a marginal quality zone, recognizing natural microbial variability while keeping a strict safety ceiling (M).

Downloaded from www.pdf.tube

124. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): When sampling chlorinated drinking water for microbiological examination, sodium thiosulfate must be added to the sample collection bottle.
Reason (R): Sodium thiosulfate neutralizes residual chlorine, preventing it from continuing to kill bacteria during transit to the laboratory.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

125. Which of the following statements correctly identifies a major advantage of using a stomacher for sample preparation over a blender?
(A) It processes samples in sterile disposable bags, eliminating the need to wash and sterilize cups between runs.
(B) The intense mechanical pounding of the stomacher completely sterilizes the food sample during the blending cycle.
(C) The stomacher utilizes high-frequency ultrasonic waves to break open bacterial cells for downstream DNA extraction.
(D) The high mechanical pressure of the stomacher paddles selectively destroys Gram-positive bacteria in the matrix.

126. Match List I with List II:
List I: (Enzyme Activity)
P. β-glucuronidase
Q. β-galactosidase
R. Coagulase
S. Lecithinase
List II: (Target Indicator Organism for specific detection)
I. Total Coliforms
II. Escherichia coli
III. Staphylococcus aureus
IV. Bacillus cereus (and sometimes S. aureus)
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-I, R-II, S-IV

127. Which of the following statements regarding the strictness of sampling plans is incorrect?
(A) Increasing the number of sample units 'n' decreases the probability of accepting a defective lot.
(B) Decreasing 'c' (the allowable number of marginal samples) increases the strictness of the plan.
(C) Sampling plans for highly lethal pathogens like E. coli O157:H7 generally require higher 'n' and c=0.
(D) A plan with c=0 is strictly a three-class sampling plan.

128. If an incubator used for MPN coliform detection is incorrectly set at 45°C instead of 35°C during the presumptive phase, what is the direct effect on the test outcome?
(A) It will cause rapid proliferation of total coliforms, leading to false positives.
(B) It will cause the lactose in the broth to instantly caramelize.
(C) The elevated temperature will inhibit non-thermotolerant coliforms, causing false negatives.
(D) It will favor the growth of strict psychrophiles.

129. Given below are two statements:
Statement I: The Limit of Detection (LOD) for a standard pour plate method using a 1 mL inoculum of a 10^{-1} dilution is $10 CFU/g$.
Statement II: The Most Probable Number (MPN) method is capable of detecting microbial concentrations lower than $10 CFU/g$ if large sample volumes (e.g., $3 \times 10g$) are inoculated.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

130. Which of the following pairs regarding E. coli is correctly matched?
(A) EHEC (e.g., O157:H7) — Characterized by rapid, standard fermentation of D-sorbitol
(B) Generic E. coli — Classified as a strict obligate anaerobe in the human gut
(C) EIEC — Synthesizes and secretes massive quantities of Shiga toxins
(D) ETEC — Enterotoxigenic E. coli (Traveler's diarrhea)

131. Applying the concept of sterile technique, what is the most likely consequence of a technician failing to change pipette tips between successive decimal dilutions (e.g., transferring from 10^{-1} to 10^{-2}, then to 10^{-3} with the same tip)?

NODIA

10. (A) Enterobacteriaceae — Failure of post-process hygiene
Monitoring Enterobacteriaceae serves as a highly reliable indicator of overall sanitation and post-processing hygiene within food facilities. Because these Gram-negative bacteria are easily inactivated by standard heat pasteurization treatments, their persistent detection in finished processed food products strongly points to inadequate heat application or secondary contamination occurring during subsequent packaging and handling stages.

11. (B) A two-class plan where c = 0
Severe foodborne pathogens that present a critical health risk, especially to vulnerable populations like infants, are monitored using a strict two-class sampling plan. Under this approach, the allowable limit for marginal results is set to zero, meaning that the detection of a single viable cell in any analyzed unit leads to immediate rejection.

12. (B) Stomacher bag — Reusable glass container
Food homogenisation protocols require specific standardized equipment and parameters to ensure accuracy. Peptone water is a standard non-selective diluent, typically mixed with the food sample at a ratio of one to ten. Stomacher bags are specially designed single-use, sterile plastic pouches, which are immediately discarded after processing to prevent sample-to-sample cross-contamination.

13. (A) Aseptically grate the cheese and add it to a pre-warmed diluent at 40°C
Hard dairy products like cheese require specialized handling during homogenisation to avoid localized overheating and cell death. Aseptically grating the product increases the surface area, while blending it with a pre-warmed diluent at forty degrees Celsius facilitates the physical dispersion of fats and proteins without compromising the viability of target microbial cells present.

14. (C) It should multiply rapidly outside the host in natural water environments.
An ideal faecal indicator must exhibit survival characteristics that closely mirror those of the enteric pathogens of concern. If an indicator organism replicates rapidly in natural water environments outside the host, its concentration will artificially inflate, leading to incorrect assessments of recent pollution and undermining its reliability as a marker of sanitary risk.

15. (D) The batch is rejected because three samples exceed the limit m, which is more than c.
In a three-class sampling plan, the number of marginal samples allowed to fall between the threshold limits is strictly restricted. With a limit of two marginal units, having three analyzed units with counts within this range exceeds the criteria. Therefore, the entire batch must be rejected, even though no individual sample exceeded the absolute maximum ceiling.

16. (C) Escherichia coli
Escherichia coli is widely recognized as the most specific and reliable indicator of recent faecal pollution in both food and water systems. Because it is a natural inhabitant of the intestinal tracts of warm-blooded animals and does not typically survive or multiply long-term in the environment, its detection indicates a direct sanitary compromise.

17. (A) I, II, and IV only
Total coliforms represent a broad group of bacteria containing environmental genera, whereas faecal coliforms are a subgroup distinguished by lactose fermentation at elevated temperatures of forty-four and a half degrees Celsius. Escherichia coli is the primary member of this thermotolerant group, serving as a specific marker for enteric contamination rather than general environmental exposure.

18. (D) Gram-negative, non-sporing, glucose-fermenting, oxidase-negative rods
The family Enterobacteriaceae is taxonomically characterized as a group of Gram-negative, rod-shaped, non-spore-forming bacteria. These microorganisms are facultative anaerobes that ferment glucose with or without gas production, and they test negative in the standard oxidase assay, which biochemically differentiates them from other Gram-negative environmental rods like Pseudomonas species.

19. (C) A is true but R is false.
Enterococci serve as robust indicators of sanitation in frozen, dried, or low-moisture foods due to their notable resistance to environmental stressors like desiccation and freezing temperatures. While vegetative coliforms quickly die off under these harsh conditions, the survival of enterococci reveals past contamination events that occurred prior to processing or storage operations.

Click Here to Buy book on Amazon

(B) II, III, and IV only
(C) I, II, and IV only
(D) I, III, and IV only

138. How is a "Reference Strain" officially defined in standard microbiological practice?
(A) A strain defined to the species level, obtained from a recognized national or international collection.
(B) A customized bacterial strain that has been genetically engineered to fluoresce brightly under ultraviolet light.
(C) Any wild pathogenic bacteria isolated directly from an infected patient that serves as a benchmark.
(D) A theoretical mathematical model of bacterial population growth kinetics used in advanced computer simulations.

139. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The enumeration of Staphylococcus aureus in processed foods is critical even if the food is subsequently reheated before consumption.
Reason (R): Staphylococcus aureus produces heat-stable enterotoxins that are not destroyed by normal cooking or reheating temperatures.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

140. Which of the following statements correctly identifies the function of the Durham tube in standard microbiological testing?
(A) It is utilized to precisely measure the absolute volume of liquid growth broth inside the test tube.
(B) It is a small inverted tube placed in broth to trap and visualize fermentation gas.
(C) It is utilized as a physical trap to capture highly motile bacterial cells escaping from the main broth.
(D) It works by actively creating a highly aerobic environmental pocket at the top of the culture tube.

141. Match List I with List II:
List I: (Biochemical Test)
P. Catalase Test
Q. Oxidase Test
R. Indole Test
S. Citrate Test
List II: (Observation indicating a Positive Result)
I. Development of a blue/purple color on the swab/filter paper
II. Formation of a red ring after adding Kovac's reagent
III. Rapid production of oxygen bubbles upon addition of H_2O_2
IV. Growth with a color change of the agar from green to blue
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-III, R-II, S-IV
(C) P-III, Q-II, R-I, S-IV
(D) P-II, Q-I, R-IV, S-III

142. Which of the following statements is incorrect regarding the FSSAI two-class sampling plan?
(A) It is applied primarily for the qualitative presence or absence testing of highly infectious foodborne pathogens.
(B) The mathematical parameters of the plan consist strictly of the two key values designated as 'n' and 'm'.
(C) The value of 'c' is always set to 1 in a standard Salmonella plan.
(D) If any single sample unit among the total number 'n' tested exceeds 'm', the entire product lot is rejected.

143. If a laboratory technician forgets to properly homogenize a solid food sample in the diluent before drawing a 1 mL aliquot for plating, what is the direct effect on the resulting plate count?
(A) The plate count will be highly accurate because target microbes migrate uniformly into the diluent on their own.
(B) The plate count will be falsely elevated because the unhomogenized diluent spontaneously generates bacterial cells.
(C) The solidifying properties of the agar are chemically neutralized, causing the poured plates to fail to solidify.
(D) The plate count will be falsely low because microbes remain trapped in the solid food.

144. Given below are two statements:
Statement I: The completed test in the MPN procedure for coliforms requires taking a colony from the confirmed EMB plate, transferring it

NODIA

(A) Cell carryover will occur, artificially inflating the final plate count.
(B) The resulting successive decimal dilutions will become completely sterile and free of any viable cells.
(C) The target bacterial cells will be physically crushed by the pipette tip, severely reducing the total count.
(D) The sterile chemical diluent will actively react with the pipette plastic to neutralize the bacterial load.

132. Which of the following pairs regarding standard microbial limits is incorrectly matched?
(A) m — Acceptable limit
(B) M — Unacceptable limit
(C) n — Total volume of the diluent used in liters
(D) c — Allowable number of samples between m and M

133. A food safety laboratory auditor reviews the equipment records. The logbook for an autoclave shows that biological indicators (Geobacillus stearothermophilus) placed inside the chamber consistently showed growth (color change in the vial) after the sterilization cycle. What does this case indicate?
(A) The cycle failed to achieve lethality, making prepared media potentially contaminated.
(B) The steam autoclave is operating perfectly and has successfully killed all resistant bacterial spores.
(C) The commercial biological indicator vial was fundamentally defective and should be completely ignored.
(D) The autoclave chamber is running excessively hot, which directly promotes rapid hyper-growth of spores.

134. Which of the following is NOT a significant source of measurement uncertainty in standard aerobic plate counts?
(A) Minor volume variations occurring during decimal pipetting steps.
(B) Small, temporary temperature fluctuations inside the main incubator.
(C) Natural clumping, chaining, or clustering of target bacterial cells.
(D) The specific brand of marker pen used to label the plates.

135. As a laboratory head, you review a completed test file for Salmonella isolation. The records show:
1. Pre-enrichment in BPW at 37°C for 18 hrs
2. Selective enrichment in RV broth at 41.5°C for 24 hrs
3. Plating on XLD agar showing red colonies with black centers
4. TSI agar showing alkaline slant/acid butt with H_2S
5. Urease test: Positive

Based on your competency in microbiology, what is the final assessment of this isolate?
(A) It is confirmed as Salmonella because of typical TSI slant/butt reactions and blackening.
(B) It is NOT Salmonella; the urease test is positive for Proteus but negative for Salmonella.
(C) It is confirmed as Escherichia coli based on the urease profile and standard XLD plate results.
(D) The test run must be abandoned because RV broth cannot be safely incubated at 41.5°C temperatures.

136. What is the fundamental basis for the selectivity of MacConkey agar used in the microbiological examination of water and food?
(A) It incorporates extremely high levels of sodium chloride to selectively inhibit non-halophilic organisms.
(B) It incorporates broad-spectrum antibiotics such as tetracycline to selectively inhibit Gram-negative rods.
(C) It contains bile salts and crystal violet to inhibit Gram-positive bacteria.
(D) It utilizes basic fuchsin dye paired with sodium sulfite to biochemically detect intermediate aldehyde production.

137. Consider the following statements about Enterobacteriaceae as hygiene indicators:
I. They are more heat resistant than standard coliforms.
II. Their presence in heat-processed foods generally indicates inadequate processing or post-processing contamination.
III. The family includes pathogens like Salmonella and Shigella.
IV. They are all obligate aerobes.
Which of the above statements are correct?
(A) I, II, and III only

Downloaded from www.pdf.tube

ANSWERS

1. (B) To assess food safety, quality, and shelf-life by measuring target microbial populations
Microbiological examination of food products focuses on monitoring and analyzing specific microbial groups or target pathogens to ensure safety, assess hygiene, determine quality, and estimate shelf life. This evaluation helps prevent foodborne outbreaks and ensures compliance with regulatory standards without requiring chemical profiling, complete sterilization, or full genetic sequencing of every single contaminant present.

2. (A) I, II, and IV only
Sampling plans dictate microbiological criteria for food safety. Two-class plans evaluate severe pathogens on a binary basis, where presence is unacceptable. Three-class plans introduce a marginal quality zone between the acceptable limit and the maximum limit. The parameter representing this maximum limit is designated as uppercase letter M, while lowercase letter m represents the marginal quality threshold.

3. (A) Mechanical breakdown of a sample to evenly distribute microbes in a diluent
Homogenisation is the initial mechanical preparation step where a food sample is thoroughly mixed with a sterile diluent, usually in a stomacher or blender. This physical process breaks down the food matrix to release trapped microorganisms, ensuring they are uniformly distributed in the liquid suspension for accurate dilution and representative subsequent plating.

4. (C) A is true but R is false.
Testing highly contaminated food samples requires serial dilution to systematically reduce the microbial concentration to a countable level. This process prevents overcrowded plates where individual colonies merge and become impossible to enumerate. The process of dilution inherently decreases rather than increases the concentration of viable microbial cells, making the corresponding justification scientifically incorrect.

5. (A) The value 'M' represents the threshold limit above which a sample is completely unacceptable.
In three-class microbiological sampling plans, the capital letter M defines the absolute maximum limit of contamination. Any single sample unit yielding a microbial count exceeding this threshold is deemed hazardous or unacceptable, resulting in the immediate rejection of the entire batch, regardless of the values obtained for other sampled units within the lot.

6. (A) P-III, Q-II, R-I, S-IV
Microbiological criteria rely on standard statistical parameters. The sample size is defined by the number of units drawn from a lot. The maximum allowable number of marginally acceptable units is designated by the letter c. The marginal quality limit is represented by lowercase m, whereas uppercase M represents the completely unacceptable or hazardous microbial limit.

7. (B) Their presence always indicates the definite presence of specific pathogenic bacteria.
Indicator organisms are utilized to evaluate sanitary conditions, process control, and potential contamination in food processing environments. While their presence suggests a higher likelihood of pathogens due to poor hygiene or process failure, it does not guarantee that specific pathogens are definitely present, as these indicators are often general, non-pathogenic environmental microorganisms.

8. (A) II - IV - III - I
Preparing food samples for microbiological testing follows a strict sequential protocol. The analyst first aseptically weighs the solid sample and adds it directly to a sterile diluent, typically at a ten-fold ratio. This mixture is then mechanically blended in a stomacher to achieve complete homogenisation before transferring an aliquot to prepare subsequent serial dilutions.

9. (C) Statement I is true but Statement II is false.
Paddled stomachers are highly preferred over traditional rotary blenders because they prevent heat buildup that can kill sensitive vegetative cells during homogenisation. Additionally, stomachers utilize sterile, single-use disposable plastic bags, which completely eliminates the labor-intensive requirement of washing, sanitizing, and autoclaving blender jars and blades between successive food samples to prevent cross-contamination.

NODIA

104. Which of the following is NOT a standard requirement for maintaining reference cultures in a food microbiology lab?
(A) Maintaining an unbroken lineage of traceability back to an accredited international culture collection.
(B) Storing backup vials at ultra-low temperatures (e.g., below -70°C) to prevent genetic drift.
(C) Subculturing the strain daily to ensure it is constantly in the log phase for all future tests.
(D) Verifying the phenotypic and genotypic purity of the reference strain before active laboratory use.

105. A laboratory uses a Levey-Jennings control chart to monitor the recovery of a known concentration of E. coli on a standard media over time. What competency is demonstrated if three consecutive data points fall outside the 2-standard-deviation (2σ) limit on the same side of the mean?
(A) The active testing process is fully stable, mathematically controlled, and highly precise.
(B) The viable concentration in the reference culture vial is naturally increasing due to adaptive evolution.
(C) The mathematical and statistical control model used to construct the chart is fundamentally flawed.
(D) A systematic error has occurred, requiring immediate troubleshooting.

106. What is the generally recommended minimum retention time for technical records, such as media preparation logs and raw data sheets, in an accredited microbiological laboratory?
(A) One single week from the date of final report issuance.
(B) One calendar month to allow for quick customer follow-ups.
(C) Determined by accreditation rules (often 2 to 5 years).
(D) Shred and destroy records immediately after printing reports.

107. Consider the following statements about interpretation challenges in microbiological food safety:
I. The "Viable But Non-Culturable" (VBNC) state can cause standard plate counts to underestimate the true risk.
II. Biofilms in food processing environments can lead to sporadic and inconsistent contamination levels in products.
III. Uneven distribution of pathogens in solid foods makes sampling highly variable.
IV. Injured cells always grow faster than healthy cells on selective media.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and IV only

108. How is the "Viable But Non-Culturable" (VBNC) state defined in foodborne bacteria?
(A) A physiological state where bacteria completely lose all metabolic activity and rapidly disintegrate within the food matrix.
(B) A state where bacteria cannot grow on routine media but remain metabolically active and potentially pathogenic.
(C) A genetic mutation where cells lose all pathogenic traits and permanently transform into beneficial probiotic organisms.
(D) The rapid physical spore formation occurring when Gram-negative vegetative cells are exposed to high cooking temperatures.

109. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The physical and chemical composition of a food matrix can significantly challenge the accurate interpretation of microbiological tests.
Reason (R): High fat content or antimicrobial spices can trap microbes or inhibit their growth during the initial enrichment or dilution phase, leading to false negatives.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

110. Which of the following statements correctly details the reporting of microbiological results when no colonies are observed on the lowest dilution plates?
(A) The result must be reported as "Absolutely Zero Viable Microbes."
(B) The laboratory should extrapolate a negative

Click Here to Buy book on Amazon

20. (C) They ferment lactose, producing acid and gas in 48 hours at $35^{\circ}C - 37^{\circ}C$.
The coliform group is defined by physiological and biochemical traits rather than strict taxonomic classification. These bacteria are Gram-negative, aerobic or facultatively anaerobic, non-spore-forming rods that possess the capability to ferment lactose, producing both acid and gas within forty-eight hours when incubated at thirty-five to thirty-seven degrees Celsius.

21. (A) P-III, Q-I, R-IV, S-II
Microbiological indicators are grouped by specific physiological behaviors. Total coliforms represent a broad environmental category, whereas faecal coliforms are thermotolerant lactose fermenters. Escherichia coli is highly specific, often identified by the enzyme beta-glucuronidase, while Enterococci are Gram-positive cocci known for surviving extreme environments, including freezing temperatures and elevated salinity.

22. (D) All strains of E. coli are highly pathogenic and cause severe foodborne illness.
Although Escherichia coli is the primary intestinal indicator of faecal pollution, the vast majority of strains are non-pathogenic commensals that pose no direct threat to human health. However, their presence in foods suggests potential exposure to enteric pathogens, which are much more difficult and costly to detect directly using standard laboratory assays.

23. (A) I - III - IV - II
The standard Most Probable Number method involves sequential presumptive, confirmed, and completed phases. The process begins by inoculating sample dilutions into selective lactose broth tubes. Following incubation to observe gas production, positive cultures are transferred to confirmed media like brilliant green bile broth, before performing streak plates and Gram staining to complete verification.

24. (C) Statement I is true but Statement II is false.
The IMViC series of biochemical tests is designed to differentiate coliform bacteria, particularly distinguishing Escherichia coli from environmental species like Enterobacter aerogenes. A typical strain of Escherichia coli produces a positive reaction for indole and methyl red, while testing negative for the Voges-Proskauer reaction and failing to utilize citrate as a sole carbon source.

25. (D) Citrate test — Detects utilization of citrate as the sole carbon source
Biochemical assays differentiate coliforms based on specific carbon utilization and metabolic byproducts. The citrate test evaluates a bacterium's capacity to utilize citrate as its sole source of carbon for growth and energy. A positive result is indicated by alkaline byproducts that raise the pH, shifting the indicator dye from green to blue.

26. (A) Coliforms likely originate from the soil rather than direct faecal pollution.
Finding high levels of total coliforms in raw or fresh vegetables without any detectable thermotolerant coliforms or Escherichia coli indicates an environmental origin. Many total coliform genera, such as Klebsiella and Enterobacter, are natural soil and plant epiphytes, meaning their presence does not confirm direct or recent faecal contamination of the agricultural product.

27. (B) Enterococci — Gram-negative rods found in the intestine
Enterococci are taxonomically classified as Gram-positive, catalase-negative, facultatively anaerobic cocci that occur in pairs or short chains. Unlike other common indicators of enteric origin, such as Enterobacteriaceae and coliforms, they are not Gram-negative rods, and they exhibit distinct tolerance to high salt concentrations, elevated pH, and pasteurization temperatures.

28. (B) Presence of non-coliform Enterobacteriaceae indicates post-treatment hygiene failure.
Detecting Enterobacteriaceae in pasteurized products, despite negative coliform tests, reveals a failure in post-processing sanitation. Since these bacteria are easily destroyed by standard pasteurization heat, their presence indicates that the product was exposed to contamination during downstream steps like cooling, storage, or packaging, even if coliform-specific bacteria were successfully excluded.

29. (A) Staphylococcus aureus
Coliforms are defined as Gram-negative, non-spore-forming, rod-shaped bacteria capable of fermenting lactose with acid and gas production. Staphylococcus aureus is a Gram-positive, catalase-positive coccus that does not belong to the Enterobacteriaceae family, thus excluding it from being classified as a member of the coliform group in standard food microbiology.

Downloaded from www.pdf.tube

bacterial contaminants present to ensure they can be easily detected and directly enumerated.

50. (D) Inoculate EC broth from positive presumptive tubes and incubate at 44.5°C for 24 hours.
To conduct a confirmatory test for faecal coliforms, the analyst inoculates EC broth tubes using culture from positive presumptive tubes. These inoculated tubes are then incubated in a water bath at forty-four and a half degrees Celsius for twenty-four hours, where positive results are confirmed by the presence of turbidity and gas.

51. (A) P-III, Q-IV, R-I, S-II
Membrane filtration protocols employ specialized media and indicators. m-Endo medium is designed for total coliforms, producing a characteristic green metallic sheen, while m-FC medium is formulated for faecal coliforms, yielding blue colonies. Rosolic acid is added to m-FC to inhibit background non-faecal organisms, ensuring high diagnostic selectivity for enteric contaminants.

52. (C) It is the method of choice for testing heavy sludge and highly turbid wastewater.
The membrane filtration technique is highly effective for processing clean water, as it allows for direct colony enumeration and rapid transfers. However, it is not the method of choice for analyzing heavy sludge or highly turbid wastewater, because the high concentration of suspended solids rapidly clogs the filter membrane, preventing filtration.

53. (A) Pre-enrichment → Selective enrichment → Plating on selective agar → Biochemical confirmation
Standard protocols for detecting Salmonella in food products follow a strict four-step sequence. The process begins with non-selective pre-enrichment, followed by selective enrichment in specialized broths. The culture is then streaked onto selective agar plates to isolate suspect colonies, which are finally subjected to biochemical and serological tests for confirmation.

54. (C) Statement I is true but Statement II is false.
The initial step in Salmonella isolation uses a non-selective pre-enrichment medium, such as buffered peptone water, to allow sub-lethally injured cells to repair and multiply. It does not immediately suppress competitive background flora; rather, selective suppression is achieved during the subsequent selective enrichment phase using highly selective liquid media.

55. (B) Selective enrichment — Tetrathionate (TT) broth
In Salmonella isolation protocols, selective enrichment media are formulated to suppress non-target competitive microflora while allowing Salmonella to replicate. Tetrathionate broth serves as a standard selective enrichment medium, containing chemical agents like tetrathionate and bile salts that inhibit Gram-positive organisms and coliforms, facilitating the recovery of the target pathogen.

56. (C) To allow sub-lethally injured Salmonella cells to repair and multiply.
During food processing, such as spray drying of milk powder, bacterial cells often sustain sub-lethal physical or chemical injuries. Direct exposure to selective agents in enrichment broths would kill these fragile cells. A non-selective pre-enrichment step provides the necessary nutrients and time for cellular repair, ensuring accurate recovery and detection.

NODIA

57. (D) MacConkey Agar — Brilliant green colonies with a distinct white halo
Salmonella species display characteristic colony morphologies on selective media. On xylose lysine deoxycholate agar they form red colonies with black centers, while bismuth sulfite agar yields black or gray colonies. However, on MacConkey agar, Salmonella produces colorless or transparent colonies because it does not ferment lactose, making the mention of green colonies incorrect.

58. (A) Typical Salmonella biochemical reactions (glucose fermentation and H_2S production).
Triple Sugar Iron agar is a key diagnostic medium used to identify enteric pathogens. A reaction showing an alkaline red slant and an acid yellow butt indicates that the isolate ferments glucose but not lactose or sucrose. The blackening of the medium confirms hydrogen sulfide production, which represents the classic biochemical profile of Salmonella.

59. (B) Urease production (Positive)
The confirmation of suspected Salmonella isolates relies on a panel of standardized biochemical assays. Typical Salmonella strains produce hydrogen sulfide, utilize lysine decarboxylase, and test negative for indole production. They do not produce the urease enzyme, which distinguishes them from other closely related enterics, such

40. (C) Brilliant Green dye — Inhibits Gram-positive bacteria and non-coliforms
Selective agents are critical in microbiological media to suppress non-target flora. Brilliant green dye is incorporated into confirmatory media because it effectively inhibits Gram-positive bacteria and many non-coliform Gram-negative organisms, allowing the selective growth and fermentation of target coliforms to be monitored without interference from competitive background microflora.

41. (D) The water sample contains high levels of suspended particulate matter and turbidity.
The Most Probable Number method is preferred over membrane filtration when analyzing water samples with high turbidity or suspended solids. Particulates clog the membrane filter pores, restricting the volume that can pass through and physically obscuring the visual development of discrete bacterial colonies on the surface, which prevents accurate enumeration.

42. (A) Indicator organism detected — Obligate anaerobes
The presumptive phase of the Most Probable Number coliform method is designed to detect facultatively anaerobic, Gram-negative rods rather than obligate anaerobes. It utilizes selective broths like lauryl sulfate tryptose at thirty-five to thirty-seven degrees Celsius, where positive reactions are recognized by the dual indicators of turbidity and visible gas production.

43. (B) The microbial load is moderate and primarily detectable at the lowest dilution (10^{-1}).
An Most Probable Number result pattern of five-zero-zero indicates a moderate microbial concentration where target organisms are present in the lowest dilution but are diluted to extinction in subsequent higher dilutions. This positive pattern allows for calculation of the estimated microbial density within the sample, demonstrating that the load is not completely overwhelming.

44. (B) It provides a direct, highly precise actual count of the target microbes.
The Most Probable Number technique is advantageous for recovering stressed cells and processing highly turbid samples. However, it does not provide a direct, highly precise actual count of individual cells. Instead, it generates a statistical estimate based on probability, which inherently carries wider confidence intervals compared to direct colony counting methods.

45. (D) 4300
When the sample sizes used in an Most Probable Number test are smaller than those listed in the standard reference table, a dilution factor must be applied. Since the inocula are one hundred times smaller than the standard ten, one, and point-one grams, the table value of forty-three must be multiplied by one hundred, yielding forty-three hundred.

46. (B) $0.45 \mu m$
The standard membrane filtration method for water quality analysis utilizes a membrane with a pore size of point-forty-five micrometers. This specific pore size is optimal because it successfully retains all target coliform bacteria on the filter surface while allowing the water sample and dissolved chemical constituents to pass through freely during vacuum filtration.

47. (B) I, II, and IV only
Membrane filtration is a highly efficient method that allows the processing of large volumes of low-turbidity water. The retained bacterial cells grow into discrete, visible colonies when the filter is placed on selective media, allowing direct enumeration. However, this technique is unsuitable for highly turbid waters, as particulates clog the filter.

48. (C) A selective bile-salt medium incubated at elevated temperatures to detect E. coli and faecal coliforms.
EC broth is a highly selective liquid medium formulated to detect Escherichia coli and thermotolerant faecal coliforms. It contains bile salts to inhibit Gram-positive bacteria and is incubated at an elevated temperature of forty-four and a half degrees Celsius, which selectively suppresses non-faecal coliforms while permitting the growth of enteric species.

49. (A) Both A and R are true and R is the correct explanation of A.
Municipal drinking water typically has very low turbidity and extremely low bacterial counts, making it ideal for the membrane filtration technique. This method allows analysts to filter large, representative volumes of water through a single membrane, concentrating any sparse

Click Here to Buy book on Amazon

contamination. While the water is non-compliant with strict standards, it suggests a need for system maintenance and line flushing rather than indicating sewage intrusion.

89. (D) Total lipid oxidation level
Packaged drinking water is subjected to extensive microbiological testing under FSSAI regulations to ensure consumer safety. This testing includes monitoring yeast and mould counts, pathogenic Vibrio cholerae, and heterotrophic plate counts. Chemical parameters like total lipid oxidation assess rancidity in fat-containing foods and are not applicable to purified drinking water.

90. (A) The entire batch must be rejected as it fails the Food Safety Criteria.
Salmonella is a severe foodborne pathogen regulated under a strict two-class sampling plan with zero tolerance. Detecting this pathogen in any single sample unit out of the five tested represents a critical safety violation. Consequently, the entire batch fails the food safety criteria and must be completely rejected to prevent human illness.

91. (B) ISO/IEC 17025
The international standard ISO/IEC seventeen thousand twenty-five outlines the general requirements for the competence, impartiality, and consistent operation of testing and calibration laboratories. Accurately performing food microbiological testing requires adherence to this standard to ensure that analytical methods, equipment calibration, personnel training, and reporting meet globally recognized quality levels.

92. (A) I, II, and III only
Quality control in media preparation is vital for reliable microbiological testing. Each batch must undergo sterility checks and performance verification using positive and negative reference cultures to confirm selective and productive properties. Prepared culture media cannot be stored indefinitely, as chemical decomposition and moisture loss alter its performance over time.

93. (A) A parameter characterizing dispersion of values attributed to a measurand.
In analytical testing, measurement uncertainty is defined as a parameter that characterizes the dispersion of values that could reasonably be attributed to the measurand. It accounts for all known sources of systematic and random variation, providing a quantitative range that reflects the level of precision and confidence in the final reported results.

94. (A) Both A and R are true and R is the correct explanation of A.
Accredited testing laboratories are required to participate in proficiency testing programs to verify their analytical competency. These programs distribute unknown samples to multiple laboratories, allowing an independent, external comparison of performance. Successfully identifying the target organisms confirms that the laboratory's equipment, methods, and analysts are capable of producing highly accurate results.

95. (D) They are authenticated strains of known characteristics used to verify media and reagent performance.
Reference cultures are authenticated, characterized strains obtained from recognized international collections, such as the ATCC. They are utilized in quality control protocols to verify the performance of culture media, reagents, and analytical methods. These strains ensure that selective media correctly inhibit non-target organisms while supporting the growth of target pathogens.

96. (A) P-IV, Q-II, R-I, S-III
Quality control frameworks rely on distinct components to ensure accuracy. Certified reference materials provide metrologically validated standards, proficiency testing assesses laboratory performance through inter-comparison, internal quality control manages daily checks like blanks or duplicates, and metrological traceability links analytical results to recognized international standards through an unbroken chain of calibrations.

97. (B) Calibration certificates for critical equipment are optional under ISO/IEC 17025.
Equipment calibration is a fundamental requirement under laboratory quality systems. Critical instruments like autoclaves, incubators, and pipettes must undergo regular calibration and performance checks to guarantee they deliver precise temperatures and volumes. Obtaining and maintaining formal calibration certificates is mandatory under ISO/IEC seventeen thousand twenty-five to demonstrate traceability.

NODIA

as Proteus species, which are strongly urease-positive.

60. (B) To isolate discrete colonies for biochemical and serological confirmation.
After completing selective enrichment, the primary goal of streaking cultures onto selective agar media, like xylose lysine deoxycholate, is to obtain well-isolated, discrete colonies. This isolation allows the analyst to observe typical colonial morphology and safely pick individual colonies for subsequent biochemical characterization and serological confirmation, ensuring accurate identification.

61. (A) Lithium chloride paired with potassium tellurite
Baird-Parker agar is highly selective for the isolation and enumeration of Staphylococcus aureus. The selectivity of this solid medium is achieved by incorporating lithium chloride and potassium tellurite, which act synergistically to inhibit the growth of competitive background microflora while allowing the target staphylococcal species to grow and form characteristic colonies.

62. (A) I, II, and IV only
Staphylococcus aureus is a Gram-positive, coagulase-positive coccus that produces highly heat-stable enterotoxins responsible for food poisoning. On Baird-Parker agar, it forms characteristic black colonies surrounded by a clear zone, which is caused by the enzymatic clearing of egg yolk emulsion rather than proteolytic degradation of the underlying beef extract.

63. (D) Clotting of rabbit plasma by the bacterial coagulase enzyme
The coagulase assay is a critical biochemical test used to confirm the identity of Staphylococcus aureus. A positive reaction is defined by the clotting or gelation of rabbit plasma within twenty-four hours of incubation. This clot formation occurs because the bacterial coagulase enzyme reacts with prothrombin factors to convert fibrinogen into fibrin.

64. (A) Both A and R are true and R is the correct explanation of A.
Listeria monocytogenes is a psychrotrophic pathogen capable of growing at refrigeration temperatures. Incorporating a cold enrichment step or using extended incubation times at low temperatures leverages this physiological trait, allowing the pathogen to replicate and outgrow competitive mesophilic microflora that are dormant or unable to multiply under cold storage conditions, ensuring accurate detection.

65. (B) It exhibits distinct umbrella-like motility in semi-solid agar at 20°C - 25°C.
Listeria monocytogenes is a Gram-positive, non-spore-forming rod-shaped bacterium. A key diagnostic feature of this pathogen is its characteristic umbrella-like pattern of motility when cultured in semi-solid agar at room temperature, between twenty and twenty-five degrees Celsius. This distinct motility, along with its ability to grow at cold temperatures, helps differentiate it from other rods.

66. (A) P-II, Q-IV, R-I, S-III
Pathogen detection relies on highly specific selective media designed to highlight unique colony features. Staphylococcus aureus is isolated on Baird-Parker agar, Listeria monocytogenes on PALCAM agar, Escherichia coli on eosin methylene blue agar, and Salmonella species on xylose lysine deoxycholate agar, facilitating accurate identification of these major foodborne pathogens.

67. (A) The tellurite provides vital growth factors to accelerate the replication rate of S. aureus.
Egg yolk tellurite emulsion is incorporated into Baird-Parker agar to serve as both a selective agent and a diagnostic indicator. Staphylococcus aureus reduces tellurite, coloring the colonies black, and utilizes egg yolk lipids to demonstrate lecithinase and lipase activity. However, tellurite acts as an inhibitor rather than a growth factor that accelerates bacterial replication.

68. (C) A pre-enrichment step is required to allow cell repair before selective agent exposure.
Sub-lethal injuries caused by food processing treatments, such as thermal pasteurization or freezing, temporarily compromise the physiological resilience of pathogens. If exposed directly to selective agents, these damaged cells will die. Therefore, a non-selective pre-enrichment step is essential to allow the injured cells to repair their structures before isolation on selective media.

69. (C) Statement I is true but Statement II is false.
Staphylococcus aureus is highly halotolerant, enabling it to grow at low water activity levels and high salt concentrations. However, it is a poor

Downloaded from www.pdf.tube

30. (C) Order a recall due to faecal contamination risks and possible enteric pathogens.
Detecting levels of Escherichia coli that exceed regulatory limits in a ready-to-eat salad presents an immediate public health risk of faecal contamination. Since this food is consumed raw without cooking, it may contain enteric pathogens. The mandatory regulatory action requires recalling the affected batch from retail shelves to protect consumers.

31. (D) Poisson distribution
The Most Probable Number method is a statistical technique based on the Poisson distribution. This mathematical model assumes that microbial cells are distributed randomly throughout a liquid sample. It calculates the probability of obtaining positive growth reactions across serial dilutions, translating tube patterns into an estimated concentration of viable organisms per volume.

32. (A) I, II, and III only
The Most Probable Number technique is an estimation method that utilizes serial decimal dilutions to determine the concentration of viable microorganisms. It is highly advantageous for testing highly turbid samples or those containing particulate matter, which physically interfere with colony visualization on agar plates, while ignoring dead cells that cannot replicate.

33. (B) A statistical estimate of viable cell concentration based on positive and negative tube patterns.
The Most Probable Number is defined as a statistical estimate of the concentration of viable microorganisms in a sample. It is determined by inoculating multiple replicate tubes across successive decimal dilutions and observing the pattern of positive growth versus negative growth, which is then compared against standardized reference probability tables.

34. (A) Both A and R are true and R is the correct explanation of A.
The presumptive phase of coliform testing occasionally yields false-positive gas production due to synergistic metabolic interactions between non-coliform bacterial species. To eliminate these false results, a completed test is performed, which requires isolating the bacteria on selective agar and confirming that they are indeed Gram-negative, non-spore-forming rods that ferment lactose.

35. (A) It inoculates positive presumptive tubes into Brilliant Green Bile (BGLB) broth.
The confirmed test for coliforms in the Most Probable Number method serves to verify the results of the presumptive phase. It involves transferring a small aliquot of culture from positive presumptive tubes into brilliant green bile broth, which contains selective agents that inhibit non-coliform organisms, and incubating it to observe gas production.

36. (A) P-II, Q-III, R-IV, S-I
The Most Probable Number protocol utilizes specific media at each diagnostic phase. The presumptive phase employs lauryl tryptose or MacConkey broth, the confirmed phase uses brilliant green bile broth, and the completed phase requires eosin methylene blue agar. Thermotolerant faecal coliform testing is selectively conducted using EC broth at elevated temperatures.

37. (A) An MPN value provides the exact, absolute number of bacterial cells in the sample.
Standard Most Probable Number tables provide a statistical estimate of microbial concentration based on positive tube combinations across decimal dilutions, rather than an exact, absolute physical count of cells. These values are reported with confidence intervals, reflecting the inherent variability of sampling and the probability distribution of organisms in suspension.

NODIA

38. (D) A high concentration of target organisms resulting in positive growth across all dilutions.
An Most Probable Number index where all tubes across all serial dilutions test positive, such as three-three-three, indicates an extremely high concentration of the target microorganism in the initial sample. This pattern shows that the dilution series was insufficient to dilute the bacteria to extinction, requiring further dilution for quantification.

39. (C) Statement I is true but Statement II is false.
During the presumptive phase of coliform testing, a small inverted Durham tube is placed inside each broth tube to physically capture and display any metabolic gas produced during fermentation. The appearance of gas bubbles within twenty-four to forty-eight hours of incubation indicates a positive presumptive result, requiring further confirmatory testing.

sanitary handling, rather than targeting specific pathogenic species or verifying complete product sterility.

79. (C) A is true but R is false.
Under drinking water standards, total coliforms must be absent in piped water entering the distribution system to verify treatment efficacy. However, coliforms themselves are generally non-pathogenic environmental organisms rather than highly infectious agents. Their presence indicates potential pathway contamination and treatment failure rather than representing a direct, severe gastrointestinal disease threat.

80. (C) E. coli must not be detectable in any 100 mL sample.
The IS ten thousand five hundred standards define strict limits to guarantee drinking water safety. The most critical biological requirement is that Escherichia coli, which specifically indicates recent faecal contamination, must not be detectable in any one hundred milliliter sample. This zero-tolerance limit is mandatory for municipal, piped, and packaged drinking water supplies.

81. (A) P-II, Q-I, R-III, S-IV
FSSAI microbiological regulations tailor testing parameters to food safety risks. Pasteurized milk focuses on process indicators like coliforms, infant formula requires complete absence of pathogens like Cronobacter, packaged drinking water demands absolute absence of coliforms and pathogens, and raw meat has higher baseline counts but strict limits on severe pathogens.

82. (D) They dictate that all raw agricultural commodities must have a total aerobic plate count of zero before retail sale.
FSSAI microbiological criteria employ statistical sampling plans to assess the safety and hygiene of food batches. While these standards apply highly stringent limits for vulnerable populations and processed foods, they do not require raw agricultural commodities to have an aerobic plate count of zero, as natural raw foods inherently harbor harmless environmental microflora.

83. (A) An immediate spike in E. coli and faecal streptococci levels.
When untreated sewage or faecal matter pollutes a water supply, it introduces massive numbers of enteric microorganisms. This contamination causes an immediate, measurable increase in the levels of key microbiological indicators, specifically Escherichia coli and faecal streptococci, which serve as highly sensitive diagnostic markers of recent sanitation failures in the water.

84. (A) Both Statement I and Statement II are true.
FSSAI regulations define two distinct classes of microbiological criteria. Food safety criteria assess the safety of products placed on the market, where failure requires product removal. Process hygiene criteria evaluate the sanitary operation of production processes, serving as early warning indicators to prompt corrective actions without necessarily triggering a product recall.

85. (A) E. coli — Indicator of recent faecal contamination
Escherichia coli is globally established as the most specific indicator organism for detecting recent faecal contamination in water supplies. Because this species resides in high numbers within the intestines of warm-blooded hosts and has limited survival times in external environments, its presence directly demonstrates a pathway for potential enteric pathogens.

86. (D) Reject the batch because two samples exceed 'm', which is more than 'c'.
Applying the rules of a three-class compliance plan, the number of samples allowed to fall within the marginal range is limited. With a parameter value of one for marginal units, having two analyzed samples exceed the lower limit of one hundred colony forming units per gram violates the criteria, requiring the rejection of the entire batch.

87. (B) Sulphite-reducing anaerobes — Allowed up to $50/100mL$
The IS ten thousand five hundred standard for drinking water establishes zero-tolerance limits for primary indicators. Escherichia coli and coliforms must be completely absent in any one hundred milliliter sample. The assertion that sulphite-reducing anaerobes are permitted at levels up to fifty organisms per volume is incorrect, as these must be absent.

88. (C) Likely distribution system integrity failure, but not necessarily fresh faecal pollution.
The presence of total coliforms in the absence of Escherichia coli at the distribution endpoint indicates a compromise in system integrity or biofilm regrowth, rather than fresh faecal

Click Here to Buy book on Amazon

sampling variability. Unlike healthy cells, injured cells require extended recovery times and grow slower on selective media.

108. (B) A state where bacteria cannot grow on routine media but remain metabolically active and potentially pathogenic.
The viable but non-culturable state is a physiological survival strategy adopted by some bacteria under environmental stress. In this state, cells lose the ability to form colonies on standard agar plates, which can result in false-negative culture tests. However, they remain metabolically active, retain their virulence genes, and can still cause disease.

109. (A) Both A and R are true and R is the correct explanation of A.
The physical structure and chemical composition of a food matrix can significantly interfere with microbiological analysis. High concentrations of fats can physically trap bacterial cells, shielding them from diluents, while natural antimicrobial compounds in spices can inhibit growth during enrichment, leading to false-negative results if these matrix effects are not addressed.

110. (C) Report as "less than 1 times the lowest dilution factor" (e.g., $< 10 CFU/g$).
When no bacterial colonies grow on the agar plates of the lowest dilution, the result cannot be reported as absolute zero or sterile. Instead, standard reporting guidelines require calculating the limit of detection based on the dilution factor, reporting the final value as less than one times the lowest dilution analyzed.

111. (A) P-II, Q-IV, R-I, S-III
A compliant quality system relies on a structured hierarchy of documentation. Standard operating procedures provide instructions for testing, equipment logbooks record machine history, certificates of analysis report final compliance results, and the quality manual serves as the overarching document defining the laboratory's quality management system policies and objectives.

112. (C) It must include the analyst's personal home address and private telephone number.
A formal microbiological test report must provide comprehensive, traceable information to ensure legal and technical validity. This includes unique sample identification, the reference methods used, and clear analytical units. For security and privacy reasons, personal contact information of the analyst, such as a home address, is never included in the report.

113. (B) They exhibit an extended lag phase while repairing cellular structures before division.
Sub-lethal physical or chemical injuries sustained by bacterial cells during food processing alter their growth kinetics. These damaged cells must repair their membranes, enzymes, and metabolic pathways before they can replicate. Consequently, they display a significantly extended lag phase, which requires adjusted incubation times to ensure accurate detection and isolation.

114. (B) Both Statement I and Statement II are false.
Microorganisms are rarely distributed uniformly within solid food matrices; instead, they often occur in localized pockets or clusters. Due to this non-homogeneous distribution, analyzing a single small sample is statistically insufficient to represent a large production batch, which is why standardized sampling plans require testing multiple sample units to ensure reliability.

115. (A) Presence of high background microflora — Overgrowth on agar plates obscuring target pathogen colonies
High levels of competitive background microflora present a major challenge in food pathogen testing. If not suppressed by selective agents, these fast-growing non-target organisms can quickly overgrow the agar surface during incubation. This overgrowth physically obscures and crowds out the slow-growing target pathogen colonies, potentially leading to false-negative visual assessments.

NODIA

116. (C) Resuscitation in a non-selective broth at room temperature before selective plating.
Recovering sub-lethally injured bacterial cells from a food sample requires a gentle, non-selective resuscitation phase. Inoculating these fragile cells directly onto selective media would result in cell death due to toxic dyes or salts. Incubating the sample in a non-selective broth at room temperature allows cell repair, ensuring accurate recovery and enumeration.

117. (A) MPN — Minimum Pathogen Number
Microbiological reporting relies on standardized acronyms to communicate quantitative and qualitative findings. Acronyms such as CFU represent colony forming units, ND means not

98. (D) Surviving bacterial spores can germinate, causing false-positive contamination results.
When an autoclave fails to reach the required sterilization temperature of one hundred twenty-one degrees Celsius, the thermal energy is insufficient to destroy highly resistant bacterial endospores. These surviving spores can germinate and grow within the prepared culture media, leading to secondary contamination that causes false-positive results during routine testing.

99. (C) Statement I is true but Statement II is false.
Positive controls are essential to verify that a testing method and its media can successfully recover and detect a known target organism. Negative controls are equally critical for all microbiological tests to ensure that media and diluents are sterile and free from background contamination, which would otherwise lead to false-positive results.

100. (C) Autoclave — Biological indicators like Geobacillus spores
Verifying autoclave lethality requires biological indicators containing resistant endospores of Geobacillus stearothermophilus. These spores are exposed to the sterilization cycle and subsequently incubated; a lack of growth demonstrates that the autoclave successfully achieved the conditions necessary to eliminate highly heat-resistant biological contaminants, confirming proper performance of the equipment.

101. (A) Review media logs, control results, and methodology for that specific test run.
When a proficiency testing result is incorrect, the laboratory must initiate a structured root cause analysis. The first step involves reviewing all records associated with that testing run, including media preparation logs, positive and negative control results, incubator temperature records, and the specific analytical techniques used, to isolate any procedural errors.

102. (D) Limit of Detection (LOD) — The maximum concentration of microbes a method can accurately quantify
Statistical terms define the performance boundaries of microbiological methods. Repeatability and reproducibility measure consistency under constant or varying conditions, while false-positive rates evaluate specificity. The limit of detection represents the lowest concentration of target microorganisms that a method can reliably detect, rather than the maximum concentration it can quantify.

103. (B) Invalidate results, investigate contamination, and repeat all tests.
The presence of bacterial colonies on a diluent blank plate demonstrates that the sterile diluent or plating process was contaminated. This compromise invalidates the entire testing run because background contaminants may have inflated the counts of the food samples. The analyst must discard the results, investigate the source of contamination, and repeat the tests.

104. (C) Subculturing the strain daily to ensure it is constantly in the log phase for all future tests.
Reference cultures must be maintained under strict conditions to prevent genetic drift and phenotypic changes. Standard protocols require storing master cultures at ultra-low temperatures and verifying their purity. Daily subculturing is avoided because repeated replication cycles increase the mutation rate and can lead to the loss of key diagnostic characteristics.

105. (D) A systematic error has occurred, requiring immediate troubleshooting.
A control chart monitors the stability and accuracy of laboratory testing over time. When multiple consecutive data points fall outside the two-standard-deviation warning limits on the same side of the mean, it indicates a statistically significant shift in recovery. This pattern points to a systematic error, requiring immediate investigation and corrective action.

106. (C) Determined by accreditation rules (often 2 to 5 years).
Maintaining comprehensive technical records is essential for demonstrating compliance during laboratory audits. These records, which include media logs, raw data, and calibration sheets, must be retained for a duration specified by accreditation bodies, which typically ranges from two to five years, ensuring that any historical testing results can be fully reconstructed.

NODIA

107. (A) I, II, and III only
Food microbiological testing faces several inherent analytical challenges. The viable but non-culturable state can lead to underestimating risks, while biofilms create highly inconsistent contamination patterns. The non-homogeneous distribution of pathogens in solid foods increases

competitor against other microorganisms. In fresh, high-moisture foods like raw meat, the abundant natural background flora rapidly outcompetes S. aureus, preventing it from multiplying and producing toxins unless competitive flora is suppressed.

70. (D) L. monocytogenes — β-hemolytic on sheep blood agar
Differentiating Listeria species requires observing hemolysis on sheep blood agar. Listeria monocytogenes exhibits weak beta-hemolysis, creating a narrow, clear zone of complete red blood cell lysis around the colonies. This hemolytic activity, which can be enhanced using the CAMP test, distinguishes it from non-hemolytic species such as Listeria innocua.

71. (B) Environmental cross-contamination after pasteurization but before packaging.
Listeria monocytogenes is a non-spore-forming bacterium that is easily destroyed by standard pasteurization temperatures. Its detection in processed deli meats that were properly cooked suggests that contamination occurred after the heating step, typically due to exposure to pathogens residing in biofilms on food contact surfaces or packaging equipment in the post-processing environment.

72. (C) Coagulase test — Negative
Staphylococcus aureus is characterized by a distinct set of biochemical traits. It is a Gram-positive coccus that clusters in grape-like arrangements, tests positive for catalase, and produces thermonuclease. However, the most critical confirmatory test is the coagulase assay, for which typical strains of this pathogen must yield a positive reaction, not a negative one.

73. (D) S. aureus produced heat-stable toxin, and later heating killed vegetative cells without destroying the toxin.
Staphylococcus aureus produces extracellular enterotoxins during growth in nutrient-rich foods. While subsequent thermal processing easily kills the vegetative bacterial cells, the toxins themselves are highly heat-resistant and survive temperatures that eliminate the live organism. Ingesting these pre-formed toxins causes food poisoning, despite negative cultural tests for viable bacteria.

74. (A) Rapid hydrogen sulfide production causing a totally black plate in 4 hours.
PALCAM agar is designed to isolate Listeria monocytogenes, leveraging esculin hydrolysis as a key diagnostic indicator. Listeria hydrolyzes esculin, which reacts with iron to form a black halo around colonies within twenty-four to forty-eight hours. It does not produce hydrogen sulfide gas to completely blacken the entire plate within four hours of incubation.

75. (B) The test is positive; the later liquefaction is likely due to staphylokinase activity destroying the clot.
A firm clot observed after four hours of incubation confirms a positive coagulase reaction. The subsequent dissolution of this clot by twenty-four hours is a known phenomenon caused by staphylokinase, a fibrinolysin enzyme produced by the same organism that degrades fibrin. Analysts must monitor tests early to avoid missing these transient positive reactions.

76. (D) Shall not be detectable in any analyzed 100 mL sample volume
The Bureau of Indian Standards drinking water specification, designated as IS ten thousand five hundred, mandates strict biological safety requirements. For both treated and untreated piped water supplies, Escherichia coli or thermotolerant coliform bacteria must not be detectable in any analyzed one hundred milliliter sample, ensuring complete absence of direct faecal contamination.

77. (A) I, II, and III only
The Food Safety and Standards Authority of India establishes microbiological criteria using statistical sampling plans. Food safety criteria target severe pathogens like Salmonella, where failure leads to product removal. Process hygiene criteria monitor general indicators like coliforms, and failing these limits indicates sanitary issues requiring corrective action rather than a mandatory national product recall.

78. (C) Estimation of the total viable aerobic population, reflecting general quality.
Aerobic Plate Count, also known as Total Viable Count, measures the concentration of mesophilic, aerobic, and facultatively anaerobic microorganisms capable of growing on non-selective agar. This count serves as a general indicator of microbiological quality, shelf life, and

Downloaded from www.pdf.tube

detected, and TNTC indicates plates with counts too numerous to count. The acronym MPN represents most probable number, which is a statistical estimate of concentration, rather than minimum pathogen number.

118. (D) PCR detected DNA from dead cells, while the cultural method only detects viable, culturable cells.
Discrepancies between molecular and cultural testing methods often arise from target differences. PCR assays detect target DNA sequences, which can persist in a food matrix long after the bacterial cells have been killed by processing. In contrast, cultural confirmation methods rely on cell replication, detecting only viable and culturable microorganisms present in the sample.

119. (B) The commercial client dislikes the final result because it means their product batch will be legally rejected.
Re-testing of food samples is authorized only when clear technical deviations undermine the validity of the analytical run, such as control failures or incubator malfunctions. A commercial client's dissatisfaction with an unfavorable result is never a valid reason to perform a retest, as doing so compromises laboratory independence and integrity.

120. (C) File a major non-conformity report because undocumented incubation parameters invalidate the testing results.
Failing to document critical testing parameters, such as incubation times and temperatures, constitutes a major non-conformity under laboratory accreditation standards. Without these records, there is no technical evidence that the tests were performed under compliant conditions, which invalidates the results. Auditors must document this finding and require formal corrective action.

121. (D) β-glucuronidase
The MUG assay is a rapid diagnostic test used to identify Escherichia coli in water and food samples. This test specifically targets the enzyme beta-glucuronidase, which is produced by almost all E. coli strains. The enzyme hydrolyzes the MUG substrate to release a fluorogenic byproduct that fluoresces bright blue under ultraviolet light.

122. (A) I, II, and IV only
Bacterial survival strategies include physiological adaptation to extreme environmental stressors. Sub-lethally injured cells display high sensitivity to selective agents, while the viable but non-culturable state is induced by starvation or cold. These states are managed in testing by utilizing rich, non-selective media during pre-enrichment, which facilitates cell repair and enables successful resuscitation.

123. (B) Assessing lab performance against set criteria using inter-laboratory comparisons.
Proficiency testing is a key external quality assurance tool used to evaluate a laboratory's testing competence. It involves analyzing identical, unknown samples distributed by an accredited provider and comparing the results against performance criteria. This comparison helps identify systematic analytical errors, verify method accuracy, and demonstrate compliance with international quality standards.

124. (A) Both A and R are true and R is the correct explanation of A.
When collecting chlorinated water samples for microbiological examination, it is essential to add sodium thiosulfate to the collection bottle. This chemical agent immediately neutralizes any residual chlorine present in the water, preventing it from continuing to kill target bacteria during transit, which would otherwise result in underestimating the true microbial load.

125. (A) It processes samples in sterile disposable bags, eliminating the need to wash and sterilize cups between runs.
A major operational advantage of using a stomacher over a traditional rotary blender is the elimination of cross-contamination risks. Because the food sample is blended inside a sterile, disposable plastic bag, the mechanical paddles never make direct contact with the mixture, which removes the requirement to wash and sterilize blending containers between samples.

126. (A) P-II, Q-I, R-III, S-IV
Enzymatic activities serve as rapid diagnostic indicators for identifying specific bacterial groups. Beta-glucuronidase is highly specific for Escherichia coli, while beta-galactosidase defines the broader total coliform group. The coagulase enzyme is the primary marker for confirming Staphylococcus aureus, whereas lecithinase

NODIA

(D) P-II, Q-III, R-IV, S-I

7. Which of the following is NOT an essential characteristic of an ideal starter culture for dairy fermentation?
(A) Predictable and rapid acid production
(B) Homofermentative or heterofermentative metabolism as required by the product
(C) Production of specific flavour compounds like diacetyl
(D) High susceptibility to bacteriophage attack

8. Arrange the typical stages of propagating a traditional dairy starter culture in the correct sequence:
I. Inoculation of the production vat
II. Activation of mother culture
III. Preparation of bulk starter
IV. Preparation of intermediate culture
Which of the following represents the correct sequence?
(A) II, IV, III, I
(B) II, III, IV, I
(C) IV, II, III, I
(D) III, IV, II, I

9. Given below are two statements regarding Lactic Acid Bacteria (LAB):
Statement I: LAB are Gram-positive, non-spore-forming, and strictly aerobic bacteria.
Statement II: LAB produce lactic acid as the major metabolic end-product of carbohydrate fermentation.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

10. Identify the correctly matched pair regarding Lactic Acid Bacteria.
(A) Streptococcus thermophilus – Commonly paired with Lactobacillus bulgaricus in yogurt
(B) Homofermentative LAB – Produce equal molar ratios of lactic acid, ethanol, and carbon dioxide
(C) Heterofermentative LAB – Rely exclusively on the Embden-Meyerhof-Parnas pathway for growth
(D) Leuconostoc mesenteroides – Highly proteolytic strains utilized for tenderizing tough meats

11. During cheese production in a commercial dairy, the fermentation process abruptly halts, and the pH remains above 6.0. The starter culture used was a defined strain of Lactococcus lactis. Which of the following is the most likely cause?
(A) Excessive dosage of rennet enzyme during the coagulation stage
(B) Premature metabolic conversion of cellular lactose to galactose
(C) Spontaneous genetic mutation of the strain into a heterofermenter
(D) Infection of the starter culture by virulent host bacteriophages

12. Identify the incorrect pair of a Lactic Acid Bacteria genus and its typical characteristic.
(A) Lactobacillus – Rod-shaped, highly acid-tolerant
(B) Leuconostoc – Obligate homofermentative, produces no gas
(C) Lactococcus – Spherical, homofermentative, primarily used in cheese
(D) Pediococcus – Divide in two planes to form tetrads

13. In formulating a new type of fermented vegetable product that requires significant gas production for texture and flavor profile, which metabolic pathway should the selected LAB predominantly utilize?
(A) Embden-Meyerhof-Parnas (EMP) pathway
(B) Tricarboxylic acid (TCA) cycle
(C) Phosphoketolase pathway
(D) Glyoxylate shunt

14. Which of the following statements about the application of Lactic Acid Bacteria (LAB) is correct?
(A) LAB are restricted solely to dairy fermentations and have no applications in vegetable matrices.
(B) LAB utilize oxidative phosphorylation as their primary pathway to generate ATP during growth.`
(C) Heterofermentative LAB typically yield exactly 2 moles of ATP per mole of glucose fermented.
(D) Bacteriocin production, such as nisin by Lactococcus lactis, inhibits Gram-positive

Click Here to Buy book on Amazon

enteric bacteria. Its selectivity is achieved by incorporating bile salts and crystal violet dye, which act as selective inhibitors that suppress the growth of Gram-positive organisms, while allowing Gram-negative rods to grow and be differentiated based on lactose fermentation.

137. (A) I, II, and III only
Enterobacteriaceae serve as robust hygiene indicators because their presence in heat-treated foods points to post-processing contamination or inadequate heat application. This large family of Gram-negative rods includes severe pathogens like Salmonella and Shigella. They are characterized as facultative anaerobes rather than obligate aerobes, and they exhibit higher thermal resistance than coliforms.

138. (A) A strain defined to the species level, obtained from a recognized national or international collection.
In professional laboratory practice, a reference strain is defined as a microorganism that is fully characterized to the species level and obtained directly from an internationally recognized culture collection, such as ATCC. These authenticated strains serve as standard benchmarks to verify the performance of media, reagents, and analytical procedures.

139. (A) Both A and R are true and R is the correct explanation of A.
Enumerating Staphylococcus aureus is essential for food safety because this pathogen produces extracellular enterotoxins during growth in susceptible foods. While reheating or cooking easily kills the vegetative bacterial cells, these pre-formed toxins are highly heat-stable and resist thermal inactivation, maintaining their capacity to cause foodborne illness even in the absence of viable cells.

140. (B) It is a small inverted tube placed in broth to trap and visualize fermentation gas.
The Durham tube is a simple, highly effective diagnostic tool used in liquid culture media. It is a small, inverted glass tube placed inside a larger test tube containing broth. During incubation, any gas produced as a byproduct of microbial carbohydrate fermentation is trapped inside the Durham tube, providing visual confirmation of metabolic activity.

NODIA

141. (A) P-III, Q-I, R-II, S-IV
Biochemical assays are verified by distinct, visible reactions. The catalase test produces rapid oxygen bubbles upon adding hydrogen peroxide, the oxidase test develops a dark purple color on indicator paper, the indole test forms a cherry-red surface ring with Kovac's reagent, and a positive citrate test displays a color shift from green to blue.

142. (C) The value of 'c' is always set to 1 in a standard Salmonella plan.
A two-class sampling plan is applied to evaluate severe pathogens where any presence constitutes a health hazard. The parameters of this plan consist of the sample size and the threshold limit. Because these pathogens are subject to a zero-tolerance policy, the allowable limit for marginal results is always set to zero, not one.

143. (D) The plate count will be falsely low because microbes remain trapped in the solid food.
Thorough sample homogenisation is required to physically release microorganisms from the solid food matrix into the liquid diluent. Failing to properly blend the sample means that the bacterial cells remain trapped within the solid food particles. Consequently, the subsequent serial dilutions will lack a representative cell suspension, resulting in a falsely low plate count.

144. (A) Both Statement I and Statement II are true.
The completed phase of the Most Probable Number coliform method provides final taxonomic verification. It requires inoculating lactose broth with a single colony from an eosin methylene blue plate and performing a Gram stain on a slant culture. A positive result is confirmed only by gas production in the broth and the presence of Gram-negative rods.

145. (B) Perishable unfrozen foods — Transported rapidly at $0^{\circ}C - 4^{\circ}C$.
Maintaining sample integrity during transport is critical to prevent changes in the microbial population prior to analysis. Frozen foods must remain frozen, while highly perishable unfrozen foods must be transported rapidly under chilled conditions, between zero and four degrees Celsius, to suppress microbial growth without freezing the cells, which could cause lethal physical damage.

(D) Immediate availability of active enzymes for dough conditioning

23. Arrange the typical biochemical phases of yeast fermentation in bread dough in the correct order:
I. Fermentation of maltose
II. Aerobic respiration depleting trapped oxygen
III. Fermentation of free endogenous sugars (glucose, fructose)
IV. Production of significant amounts of ethanol and CO_2
Which of the following represents the correct sequence?
(A) III, II, IV, I
(B) I, II, III, IV
(C) II, I, III, IV
(D) II, III, I, IV

24. Given below are two statements regarding sourdough fermentation:
Statement I: Sourdough fermentation relies exclusively on commercial baker's yeast without bacterial involvement.
Statement II: The symbiotic relationship in sourdough typically involves lactic acid bacteria and acid-tolerant yeasts.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

25. Identify the correctly matched pair regarding moulds used in food production.
(A) Penicillium roqueforti – Fermentation of tempeh
(B) Rhizopus oligosporus – Ripening of Camembert cheese
(C) Aspergillus oryzae – Production of soy sauce and sake
(D) Aspergillus niger – Exclusively a pathogenic food spoiler

26. A batch of soy sauce exhibits poor flavor development and insufficient breakdown of soy proteins and carbohydrates. Which specific phase of the process, involving mould, most likely failed?
(A) The Koji preparation phase
(B) The Moromi fermentation phase
(C) The final pasteurization phase
(D) The lactic acid fermentation phase

27. Identify the incorrect pair regarding the action of moulds in fermented foods.
(A) Rhizopus oligosporus – Binds soybeans into a solid cake (Tempeh)
(B) Penicillium camemberti – Forms a white mycelial crust on cheese surface
(C) Aspergillus niger – Commercial production of citric acid
(D) Penicillium roqueforti – Produces aflatoxins in blue-veined cheese

28. When designing a solid-state fermentation process utilizing Aspergillus oryzae, which of the following environmental parameters must be strictly controlled to ensure optimal amylase production rather than sporulation?
(A) Total exclusion of oxygen from the reaction vessel
(B) Water activity (a_w), temperature, and aeration
(C) Extremely elevated moisture content levels above 95%
(D) Exposure to ultra-high hydrostatic pressure conditions

29. Which of the following statements about moulds in the genus Rhizopus is correct?
(A) They are characterized by septate hyphae and strictly synthesize penicillin.
(B) They are obligate anaerobes that cannot survive on dry solid food surfaces.
(C) They are zygomycete molds that play a crucial role in producing tempeh.
(D) They secrete lethal botulinum neurotoxins during fermentation of legumes.

30. What is the primary biochemical effect of Penicillium roqueforti during the ripening of blue cheese?
(A) Conversion of lactose directly to ethanol and carbon dioxide gas
(B) Synthesis of massive amounts of lactic acid to drop pH below 4.0
(C) Enzymatic coagulation of milk proteins to completely bypass rennet
(D) Intense lipolysis releasing fatty acids that impart sharp flavors

Downloaded from www.pdf.tube

CHAPTER 12

Beneficial Microorganisms: Single Cell Protein (SCP), Prebiotics and Probiotics

1. Which of the following best describes the primary role of beneficial microorganisms in commercial food production?
(A) To eliminate cellular metabolic activities and prevent biochemical changes
(B) To drive biochemical changes that enhance shelf-life, texture, and flavor
(C) To act strictly as chemical preservatives without altering nutrition
(D) To sterilize the food matrix by directly eliminating pathogenic bacteria

2. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Selected strains of beneficial microorganisms used in food fermentation are classified as GRAS.
Reason (R): GRAS organisms have a proven history of safe use and do not produce toxins or cause infections in healthy humans.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

3. What is the precise definition of a "starter culture" in food technology?
(A) A pure chemical additive used to initiate rapid catalytic degradation
(B) Any naturally occurring wild microbiota present on the raw food surface
(C) A defined formulation of live microbes added to initiate fermentation
(D) A heat-killed microbial cell suspension utilized to stabilize food pH

4. Consider the following statements regarding the preparation of starter cultures:
I. Mother cultures are maintained under strict aseptic conditions to prevent contamination.
II. Bulk starters are directly used to inoculate the final production vat.
III. Lyophilization is rarely used for commercial starter culture distribution due to cell death.
IV. Cryoprotectants are essential for the survival of deep-frozen starter cultures.
Which of the statements given above are correct?
(A) II, III and IV only
(B) I, II and III only
(C) I, III and IV only
(D) I, II and IV only

5. Identify the incorrect statement concerning the maintenance of commercial starter cultures.
(A) Regular subculturing in liquid media is the preferred method for long-term genetic stability.
(B) Freeze-drying (lyophilization) helps preserve cultures in a dormant state for extended periods.
(C) Regular subculturing in liquid media is the preferred method for long-term genetic stability.
(D) Storage at cryogenic temperatures using liquid nitrogen minimizes metabolic activity.

6. Match the type of starter culture preparation (List I) with its characteristic (List II).
List I: (Starter Culture Preparation)
P. Liquid starter
Q. Lyophilized starter
R. Deep-frozen starter
S. Direct Vat Set (DVS)
List II: (Characteristic)
I. Highly concentrated, requires no intermediate subculturing
II. Short shelf life, requires regular subculturing
III. Stored in liquid nitrogen at -196°C
IV. Freeze-dried powder, requires reactivation before use
(A) P-IV, Q-II, R-I, S-III
(B) P-II, Q-IV, R-III, S-I
(C) P-I, Q-III, R-II, S-IV

NODIA

activity is commonly used to screen for Bacillus cereus.

127. (D) A plan with $c = 0$ is strictly a three-class sampling plan.
The strictness of a sampling plan is determined by its parameters. Increasing the sample size or decreasing the number of allowable marginal units reduces the probability of accepting contaminated batches. For highly hazardous pathogens, plans are designed with zero tolerance, which represents a strict two-class plan rather than a three-class sampling plan.

128. (C) The elevated temperature will inhibit non-thermotolerant coliforms, causing false negatives.
Standard coliform bacteria are mesophilic and require moderate temperatures, typically thirty-five to thirty-seven degrees Celsius, to grow and ferment lactose. Raising the presumptive phase incubation temperature to forty-five degrees Celsius acts as a selective barrier, inhibiting non-thermotolerant coliforms and preventing their replication, which directly results in false-negative test outcomes.

129. (A) Both Statement I and Statement II are true.
The limit of detection varies significantly between testing methods. For a standard pour plate method using a ten-fold dilution, the baseline limit of detection is ten colony forming units per gram. The Most Probable Number method can achieve a lower limit of detection by using larger, concentrated sample inocula, enabling detection of sparse contaminants.

130. (D) ETEC — Enterotoxigenic E. coli (Traveler's diarrhea)
Escherichia coli strains are classified into distinct pathotypes based on virulence factors and clinical symptoms. Enterotoxigenic E. coli is a major cause of traveler's diarrhea, producing heat-labile or heat-stable enterotoxins. In contrast, enterohemorrhagic strains, such as O157:H7, do not ferment D-sorbitol rapidly, which biochemically differentiates them from generic E. coli.

131. (A) Cell carryover will occur, artificially inflating the final plate count.
Proper pipetting technique is essential to prevent carryover contamination between serial dilutions. If an analyst uses the same pipette tip across successive dilution steps, residual high-concentration bacterial suspension is transferred into the higher dilution tubes. This carryover bypasses the intended ten-fold dilution factor, artificially inflating the final colony count on plates.

132. (C) n — Total volume of the diluent used in liters
Statistical sampling plans utilize standardized alphabetical designations to define testing criteria. The lower and upper microbial limits are represented by the letters m and M, respectively, while the maximum allowable number of marginal units is denoted by c. The letter n represents the number of sample units drawn from a lot, not the diluent volume.

133. (A) The cycle failed to achieve lethality, making prepared media potentially contaminated.
Biological indicators verify that autoclave sterilization cycles achieve sufficient lethality. If Geobacillus stearothermophilus spores survive and grow after a cycle, it demonstrates that the autoclave failed to reach or maintain the required sterilizing conditions. Consequently, any media prepared in that run may not be sterile, presenting a risk of secondary contamination.

134. (D) The specific brand of marker pen used to label the plates.
Measurement uncertainty in microbiological plate counts is influenced by technical and biological factors. Significant sources of variation include pipette volume tolerances, incubator temperature fluctuations, and natural cell clumping. Administrative actions, such as the specific brand of pen used to mark colonies on the plate, do not affect cell viability or influence the uncertainty calculation.

135. (B) It is NOT Salmonella; the urease test is positive for Proteus but negative for Salmonella.
While the isolated bacterium displayed typical colony morphology on selective agar and generated a characteristic reaction on Triple Sugar Iron agar, the positive urease test is a critical negative indicator. Authentic Salmonella strains are urease-negative. This positive urease reaction indicates a closely related enteric competitor, such as a Proteus species, rather than Salmonella.

136. (C) It contains bile salts and crystal violet to inhibit Gram-positive bacteria.
MacConkey agar is a selective and differential medium widely used to isolate Gram-negative

Click Here to Buy book on Amazon

pathogens.

15. What is the primary effect of rapid initial acidification by starter cultures in fermented food production?
(A) Suppression of pathogenic and spoilage microorganisms
(B) Enhancement of yeast sporulation and ascospore survival
(C) Increase in the solubility of key structural proteins
(D) Complete metabolic degradation of dietary lipid complexes

16. Which physiological characteristic allows Saccharomyces cerevisiae to be exceptionally effective in baking?
(A) Its rapid metabolic conversion of lipid fractions into volatile fatty acids
(B) Its rapid alcoholic fermentation in dough yielding carbon dioxide
(C) Its physiological requirement for high salt levels to activate zymase
(D) Its strict biological classification as an obligate anaerobic organism

17. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Saccharomyces cerevisiae exhibits the Crabtree effect.
Reason (R): Under high glucose concentrations, Saccharomyces cerevisiae produces ethanol aerobically rather than fully respiring the sugar.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

18. Which of the following defines the term "baker's yeast"?
(A) Strains of Saccharomyces cerevisiae selected for rapid leavening and CO_2 yield
(B) Any yeast species capable of surviving baking temperatures exceeding 100 degrees
(C) A complex microbial mixture of environmental moulds and yeasts for souring dough
(D) Specific strains of Candida albicans used to modify and enhance bread crust color

19. Consider the following statements about yeasts used in food production:
I. Kluyveromyces marxianus is known for its ability to ferment lactose.
II. Saccharomyces cerevisiae can ferment lactose directly to ethanol.
III. Zygosaccharomyces rouxii is osmophilic and used in soy sauce fermentation.
IV. Yeasts primarily reproduce by binary fission.
Which of the statements given above are correct?
(A) II, III and IV only
(B) I, II and IV only
(C) I and III only
(D) I and IV only

20. Identify the incorrect statement regarding yeast applications in the food industry.
(A) Yeast extracts are widely used as flavor enhancers due to their high nucleotide and amino acid content.
(B) Saccharomyces ellipsoideus is frequently used in the wine industry for alcoholic fermentation.
(C) In brewing, top-fermenting yeasts (S. cerevisiae) are typically used for ales.
(D) Yeasts are generally responsible for the production of propionic acid in Swiss cheese.

21. Match the microorganism (List I) with its specific food application (List II).
List I: (Microorganism)
P. Saccharomyces cerevisiae
Q. Kluyveromyces lactis
R. Zygosaccharomyces bailii
S. Candida milleri
List II: (Food Application)
I. Sourdough fermentation
II. Spoilage in acidic/preservative-rich foods
III. Production of lactase enzyme
IV. Ale brewing
(A) P-III, Q-IV, R-I, S-II
(B) P-IV, Q-I, R-II, S-III
(C) P-IV, Q-III, R-II, S-I
(D) P-I, Q-II, R-III, S-IV

22. Which of the following is NOT an advantage of using compressed fresh yeast over active dry yeast in industrial baking?
(A) Faster initial fermentation rate
(B) Longer shelf-life at room temperature without loss of viability
(C) Higher moisture content, making it easier to disperse in dough

Downloaded from www.pdf.tube

Statement I: SCP is generally rich in essential amino acids, although sulfur-containing amino acids (methionine and cysteine) may be limiting.
Statement II: The high nucleic acid content in raw SCP poses no health risks to humans and enhances its nutritional value.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

40. Identify the correctly matched pair regarding SCP microorganisms and their substrates.
(A) Methylophilus methylotrophus – Methanol
(B) Saccharomyces cerevisiae – Hydrocarbons
(C) Spirulina – Sulphite waste liquor
(D) Candida lipolytica – Carbon dioxide and sunlight

41. A factory proposes using an uncharacterized paper mill effluent for SCP production intended for human consumption. What is the most critical food safety concern that must be evaluated?
(A) The presence of unfermented residual sugars remaining in the effluent
(B) The aesthetic color of the final spray-dried microbial protein powder
(C) Bioaccumulation of toxic heavy metals and organic pollutants in cells
(D) The high concentration of water-soluble B-complex vitamins in product

42. Identify the incorrect pair related to SCP production.
(A) Chlorella – Grown strictly in dark, anaerobic conditions
(B) Spirulina – Cultivated in highly alkaline open ponds
(C) Fusarium venenatum – Utilized to produce Quorn
(D) Candida utilis – Capable of utilizing pentose sugars from hemicellulose

43. If a fungal biomass intended for human food has an RNA content of 10%, which processing step is most crucial to apply before commercialization?
(A) Chemical fortification of the dried biomass with purine bases
(B) High-pressure homogenization to increase intracellular RNA stability
(C) Submerged fermentation at highly acidic pH to preserve nucleic acids
(D) Heat shock at 64-68°C to activate endogenous RNases

44. Which of the following statements about the commercial SCP product "Quorn" is correct?
(A) It is derived from a genetically modified strain of Escherichia coli.
(B) The mycoprotein structure imparts a fibrous, meat-like texture.
(C) It is predominantly composed of pure fat with trace proteins.
(D) It is an algal product requiring extensive photosynthesis for growth.

45. What is the primary adverse health effect in humans associated with the overconsumption of untreated, high-nucleic-acid Single Cell Protein?
(A) Progressive onset of acute chronic liver cirrhosis
(B) Development of severe gastrointestinal lactose intolerance
(C) Uric acid accumulation causing gout and kidney stones
(D) Severe clinical deficiency of active cobalamin (B12)

NODIA

46. Which microorganism is primarily recognized for its commercial success in forming the basis of mycoprotein products like Quorn?
(A) Candida utilis
(B) Chlorella vulgaris
(C) Methylophilus methylotrophus
(D) Fusarium venenatum

47. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The World Health Organization (WHO) restricts the allowable intake of nucleic acids from SCP in the human diet to about 2 grams per day.
Reason (R): Humans lack the enzyme uricase, which converts uric acid to highly soluble allantoin.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

31. Which of the following bacteria is primarily utilized in the production of traditional yogurt along with Lactobacillus delbrueckii subsp. bulgaricus?
(A) Streptococcus thermophilus
(B) Lactococcus lactis
(C) Bifidobacterium bifidum
(D) Propionibacterium freudenreichii

32. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The combination of Streptococcus thermophilus and Lactobacillus bulgaricus in yogurt production is known as proto-cooperation.
Reason (R): S. thermophilus produces formic acid which stimulates L. bulgaricus, while L. bulgaricus produces amino acids that stimulate S. thermophilus.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

33. How is "Single Cell Protein" (SCP) best defined?
(A) Protein isolated and purified strictly from single-celled animal tissues
(B) Dried microbial cells used as protein supplements in food or animal feed
(C) Synthetic protein manufactured via recombinant DNA technology in single cells
(D) Pure protein isolated from a single species of genetically modified plant

34. Consider the following substrates used for Single Cell Protein (SCP) production:
I. Molasses and whey are common carbon sources.
II. Lignocellulosic agricultural wastes require chemical or enzymatic pretreatment.
III. Methane and methanol can be utilized by certain methylotrophic bacteria for SCP.
IV. High concentrations of heavy metals are added to maximize biomass yield.
Which of the statements given above are correct?
(A) I, II and III only
(B) II, III and IV only
(C) I, II and IV only
(D) I, III and IV only

35. Identify the incorrect statement regarding the characteristics of Single Cell Protein (SCP).
(A) It has a high protein content, ranging from 40% to 80% on dry weight basis.
(B) Its micro-organisms are cultivated on cheap, raw agro-industrial wastes.
(C) Its cultivation requires vast arable land and depends on seasonal climates.
(D) It contains rich levels of micro-nutrients, mostly B-complex vitamins.

36. Match the SCP microorganism (List I) with its typical classification or characteristic (List II).
List I: (SCP Microorganism)
P. Spirulina maxima
Q. Chlorella
R. Candida utilis
S. Fusarium venenatum
List II: (Classification or Characteristic)
I. Green microalgae
II. Filamentous microfungus (mycoprotein)
III. Cyanobacterium (blue-green algae)
IV. Yeast widely used for fodder
(A) P-I, Q-III, R-II, S-IV
(B) P-III, Q-II, R-IV, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-I, R-IV, S-II

37. Which of the following is NOT an advantage of using agro-industrial wastes for SCP production?
(A) Reduction of environmental pollution by utilizing high-BOD effluents
(B) Conversion of low-value waste into high-value protein
(C) Zero requirement for downstream processing or purification
(D) Independence from traditional agricultural land constraints

38. Which of the following represents an accurate sequence for the downstream processing of SCP biomass from a liquid fermentation broth?
(A) Fermentation → Drying → Cell disruption → Harvesting
(B) Harvesting → Washing → Nucleic acid reduction → Drying
(C) Washing → Drying → Fermentation → Harvesting
(D) Nucleic acid reduction → Fermentation → Washing → Drying

39. Given below are two statements regarding the nutritional composition of SCP:

Click Here to Buy book on Amazon

146. (D) Non-compliant, because E. coli must be completely absent in the sample volume.
Under both FSSAI regulations and IS ten thousand five hundred standards, there is a strict zero-tolerance policy for sanitary indicators in drinking water. Finding three colonies of Escherichia coli in a two hundred fifty milliliter sample represents a direct safety violation. This result renders the batch non-compliant, as these bacteria must be completely absent.

147. (A) Method Validation — Verifying that an instrument is clean
Quality assurance in testing laboratories requires maintaining accurate documentation. Raw data represents the original observations, an audit trail records chronological actions, and deviations document departures from standard procedures. Method validation is an extensive process to verify that an analytical method is fit for its intended purpose, rather than simply checking if an instrument is clean.

148. (C) Invalid, because failed positive controls indicate systemic testing or media failure.
Positive controls are essential to verify that the media, incubation conditions, and analytical techniques are capable of recovering the target pathogen. If a known control strain of Salmonella fails to grow on the selective agar, the entire testing run is invalid, as the negative results obtained for the food samples may represent false negatives.

149. (A) Improved measurement uncertainty calculations
A poorly designed laboratory layout where incoming samples are processed adjacent to active pathogen isolation areas creates a serious risk of cross-contamination. This physical proximity can introduce pathogens into raw samples, leading to false-positive results and compromising environmental monitoring. It does not improve measurement uncertainty calculations, as it introduces uncontrolled systematic errors into the testing system.

150. (D) To define a marginal quality zone, recognizing natural microbial variability while keeping a strict safety ceiling (M).
The distinction between the parameters designated as lowercase m and uppercase M in a three-class sampling plan is designed to accommodate natural microbial variation in processed foods. This framework establishes a marginal quality zone for acceptable variation under good manufacturing practices, while imposing a strict upper safety ceiling above which a batch is rejected.

www.nodia.in

NODIA

48. According to the FAO/WHO, how are "probiotics" officially defined?
(A) Non-viable microbial cells formulated to stimulate host immunity
(B) Live microbes which, in adequate amounts, confer host health benefits
(C) Any naturally occurring bacteria residing in human gastrointestinal tracts
(D) Raw or processed fermented foods containing active lactic acid bacteria

49. Consider the following criteria for selecting a probiotic strain:
I. Resistance to gastric acidity and bile toxicity.
II. Ability to adhere to intestinal mucosa.
III. Capacity to transfer antibiotic resistance genes to gut microbiota.
IV. Proven safety and non-pathogenicity in humans.
Which of the criteria given above are essential for a good probiotic?
(A) II, III and IV only
(B) I, II and IV only
(C) I, III and IV only
(D) I and II only

50. Identify the incorrect statement regarding the health benefits of probiotics.
(A) Probiotics can completely cure all types of inflammatory bowel disease (IBD) within days.
(B) Probiotics can help alleviate symptoms of lactose intolerance by providing the enzyme β-galactosidase.
(C) Certain probiotic strains can modulate both local and systemic immune responses.
(D) Probiotics may help prevent antibiotic-associated diarrhea.

51. Match the probiotic strain (List I) with its widely recognized specific health benefit or mechanism (List II).
List I: (Probiotic Strain)
P. Lacticaseibacillus rhamnosus GG
Q. Bifidobacterium animalis subsp. lactis
R. Saccharomyces boulardii
S. Lactobacillus delbrueckii subsp. bulgaricus
List II: (Health Benefit or Mechanism)
I. Primarily used as a starter culture; limited survival in the gut
II. Prevention and treatment of antibiotic-associated diarrhea (yeast)
III. Strong clinical evidence for pediatric rotavirus diarrhea
IV. Improvement of bowel transit time and gut regularity
(A) P-IV, Q-III, R-I, S-II
(B) P-II, Q-I, R-IV, S-III
(C) P-III, Q-IV, R-II, S-I
(D) P-III, Q-II, R-IV, S-I

52. Which of the following is NOT generally considered a mechanism of action for probiotics in the gut?
(A) Secretory production of antimicrobial substances like bacteriocins
(B) Competitive exclusion for adhesion sites on intestinal epithelium
(C) Enhancement of cellular barriers in intestinal epithelial systems
(D) Destruction of native microbiota to reset the immune system

53. A food technologist is evaluating a new bacterial strain for probiotic potential. The strain shows excellent health benefits in vitro but rapidly loses viability at pH 2.0 and in the presence of 0.3% oxgall. What is the most appropriate conclusion regarding this strain?
(A) It is perfectly suited for direct use in non-encapsulated liquid dairy drinks
(B) It exhibits highly pathogenic characteristics and must be discarded immediately
(C) It requires protective delivery technologies to survive gastric transit
(D) It fully satisfies all official FAO/WHO criteria for ideal probiotic strains

54. Given below are two statements regarding the delivery of probiotics:
Statement I: Fermented dairy products, such as yogurt and kefir, are traditional and effective delivery vehicles for probiotics.
Statement II: The buffering capacity of milk proteins significantly decreases the survival rate of probiotics in the stomach.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

Downloaded from www.pdf.tube

55. Identify the correctly matched pair regarding probiotic delivery systems.
(A) Lyophilization – Irreversibly destroys all probiotic cell membrane structures
(B) Extrusion – A purely chemical process used for killing probiotic bacteria
(C) Enteric coating – Ensures probiotics dissolve quickly in the acidic stomach
(D) Microencapsulation – Protects probiotic cells from harsh environment

56. During the shelf-life testing of a commercial probiotic yogurt, it is observed that the viable count of Bifidobacterium drops from 10^8 CFU/g to CFU/g within two weeks. What is the most likely cause of this rapid decline?
(A) High oxygen permeability of the packaging and low pH of the yogurt.
(B) The strain exhibits strong resistance to post-acidification.
(C) Storage of the product at ideal refrigeration temperatures (4°C).
(D) The addition of a prebiotic like inulin to the yogurt formulation.

57. Identify the incorrect pair regarding the survival factors of probiotics in the GI tract.
(A) Gastric acid – Low pH environment causing cellular stress
(B) Bile salts – Act as detergents disrupting bacterial cell membranes
(C) Pepsin – A proteolytic enzyme that enhances probiotic membrane integrity
(D) Pancreatin – A mixture of digestive enzymes presenting a hurdle in the small intestine

58. To improve the viability of probiotic bacteria incorporated into a fruit juice, which technological intervention would be most effective?
(A) Microencapsulation using sodium alginate and calcium chloride
(B) High-temperature short-time (HTST) pasteurization after adding the probiotic
(C) Increasing the titratable acidity of the juice
(D) Subjecting the final product to intense gamma irradiation

59. Which of the following statements about probiotic survival through food processing is correct?
(A) Spray drying of probiotic bacteria is completely lethal and never applied in food industries.
(B) Freezing of cell suspensions has absolutely no impact on the survival of unprotected cells.
(C) High hydrostatic pressure is the primary industrial method used to activate dormant spores.
(D) Sublethal stress pre-treatment enhances subsequent tolerance to harsh conditions.

NODIA

60. What is the most appropriate minimum concentration of viable probiotic cells generally required in a food product at the time of consumption to exert a beneficial effect?
(A) $10^2 - 10^3$ CFU/g
(B) $10^6 - 10^7$ CFU/g
(C) $10^4 - 10^5$ CFU/g
(D) $10^{11} - 10^{12}$ CFU/g

61. What is the scientific definition of a prebiotic?
(A) A live, viable microbial cell preparation that assists active digestion
(B) A broad-spectrum systemic antibiotic therapy targeting clinical pathogens
(C) A selectively utilized substrate that confers a host health benefit
(D) An inactive, heat-treated enzyme added to raw foods to prevent spoilage

62. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Inulin and Fructooligosaccharides (FOS) are widely recognized as prebiotics.
Reason (R): They escape digestion in the upper gastrointestinal tract and are selectively fermented by bifidobacteria in the colon.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

63. Which of the following molecules represents GOS, a common prebiotic?
(A) Galactooligosaccharides
(B) Glucooligosaccharides
(C) Glycogen-oligosaccharides
(D) Glutamate-oligosaccharides

64. Consider the following carbohydrates:
I. Inulin
II. Resistant starch

III. Fructooligosaccharides (FOS)
IV. Sucrose
Which of the above are classified as prebiotics or prebiotic-like compounds?
(A) I, II and IV only
(B) I, II and III only
(C) III and IV only
(D) I, III and IV only

65. Identify the incorrect statement regarding the mechanism of prebiotic action.
(A) Fermentation of prebiotics by gut microbiota produces short-chain fatty acids (SCFAs).
(B) Prebiotics are hydrolyzed by human salivary and pancreatic amylases.
(C) Prebiotics can promote an acidic environment in the colon, inhibiting pathogenic growth.
(D) Prebiotics selectively stimulate the growth or activity of beneficial bacteria.

66. Match the prebiotic/dietary fiber (List I) with its typical structural characteristic or source (List II).
List I: (Prebiotic/Dietary Fiber)
P. Inulin
Q. GOS
R. Resistant Starch
S. Lactulose
List II: (Structural Characteristic or Source)
I. Synthesized from lactose via enzymatic transgalactosylation
II. A polymer of fructose extracted commonly from chicory root
III. Escapes digestion in the small intestine, found in green bananas
IV. A synthetic disaccharide of galactose and fructose
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-IV, R-III, S-I
(D) P-III, Q-I, R-II, S-IV

67. Which of the following is NOT an outcome of Short-Chain Fatty Acid (SCFA) production in the gut resulting from prebiotic fermentation?
(A) Lowering of luminal pH
(B) Provision of energy for colonocytes (especially butyrate)
(C) Elevation of systemic blood glucose levels
(D) Increase in the solubility and absorption of calcium and magnesium

68. A manufacturer aims to formulate a dietary supplement that provides a synergistic effect by combining a live probiotic strain with a specific substrate it preferentially utilizes. What is this concept known as?
(A) Antibiotic therapy
(B) Postbiotic formulation
(C) Metabiotics
(D) Synbiotic concept

69. Given below are two statements regarding synbiotics:
Statement I: A complementary synbiotic consists of a probiotic and a prebiotic that work independently to achieve one or more health benefits.
Statement II: A synergistic synbiotic is designed such that the prebiotic specifically stimulates the co-administered probiotic strain.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

70. Identify the correctly matched pair regarding gut microbiota metabolites.
(A) Butyrate – A toxic metabolic compound causing colon inflammation
(B) Acetate – A short-chain fatty acid produced by fermentation
(C) Hydrogen sulfide – A highly beneficial short-chain fatty acid
(D) Lactic acid – An alkaline substance that rapidly raises gut pH

71. A clinical trial investigates a synbiotic containing Bifidobacterium longum and FOS. The results show massive proliferation of B. longum but no change in host SCFA levels or gut barrier function. Does this meet the FAO/WHO requirement for a beneficial synbiotic?
(A) Yes, because microbial proliferation in vivo is the only vital requirement
(B) Yes, provided the prebiotic oligosaccharide is fully and actively utilized
(C) No, because the clinical strain of B. longum is a well-known human pathogen
(D) No, because a health benefit to the host is fundamentally required

Click Here to Buy book on Amazon

72. Identify the incorrect pair regarding the regulatory standards of pre/probiotics in India.
(A) Viable count – Not mandated; dead cells are classified as probiotics
(B) FSSAI – The primary regulatory authority for health nutraceuticals
(C) ICMR-DBT – Issued official guidelines for probiotic food evaluation
(D) Health claims – Must be backed by robust evidence and approved by FSSAI

73. When formulating a commercial prebiotic beverage, the food technologist observes that the added FOS undergoes significant hydrolysis during thermal processing at low pH. Which of the following is the most scientifically sound application to solve this?
(A) Increase thermal processing times to achieve sterile batches
(B) Add alkaline salts to raise pH to 9.0 prior to processing
(C) Substitute FOS with a more heat-stable prebiotic like GOS
(D) Add active invertase enzymes to stabilize chemical structures

74. Which of the following statements about FSSAI labelling requirements for probiotic products is correct?
(A) The label must declare the specific strain of probiotics added.
(B) Only the genus classification of the probiotic is required on packaging.`
(C) Probiotic foods are completely exempt from carrying a "Best Before" date.
(D) Probiotic health claims can be printed freely without scientific trials.

75. What is the most appropriate description of the "gut-brain axis" in emerging microbiome research?
(A) A one-way pathway where the brain strictly dictates microbiota composition
(B) The direct, physical structural connection of gut tissues to the brain stem
(C) The physical route by which probiotics enter blood and travel to the brain
(D) Bidirectional signaling linking the enteric and central nervous systems

76. Which of the following bacteria is an anaerobic, Gram-positive, Y-shaped rod that is a major component of the human infant gut microbiota and commonly used as a probiotic?
(A) Escherichia coli strain
(B) Bifidobacterium bifidum
(C) Bacillus subtilis strain
(D) Staphylococcus aureus

NODIA

77. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Regular consumption of specific probiotic strains can enhance the host's immune response.
Reason (R): Probiotics interact with gut-associated lymphoid tissue (GALT), stimulating IgA production and modulating cytokine profiles.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

78. What is the definition of "Postbiotics"?
(A) Live, active microbial strains that directly compete with prebiotics in the colon
(B) Synthetic chemical compounds formulated to actively stimulate gastrointestinal motility
(C) Specific prebiotic dietary fibers designed to selectively feed native gut probiotics
(D) Preparation of inanimate microbes and components conferring a host health benefit

79. Consider the following regarding the safety of Single Cell Protein (SCP):
I. SCP derived from fungi may trigger allergic reactions in a small subset of the population.
II. Aflatoxin contamination is a serious risk if Aspergillus flavus is used improperly.
III. Mycotoxin screening is a mandatory safety step in fungal SCP production.
IV. High RNA content in SCP prevents protein synthesis in humans.
Which of the statements given above are correct?
(A) I, II and III only
(B) II, III and IV only
(C) I, III and IV only
(D) I and II only

80. Identify the incorrect statement regarding emerging research on the gut microbiome.
(A) Dysbiosis of the gut microbiota has been linked to metabolic disorders like obesity

and type 2 diabetes.
(B) The gut microbiome composition is entirely static and unaffected by dietary changes.
(C) Short-chain fatty acids (SCFAs) play a role in regulating the integrity of the blood-brain barrier.
(D) Metagenomic sequencing has drastically improved our understanding of unculturable gut microbes.

81. Match the regulatory aspect (List I) with its corresponding FSSAI requirement for probiotics (List II).
List I: (Regulatory Aspect)
P. Viable microorganism count
Q. Taxonomic identification
R. Warning statement
S. Health claims
List II: (FSSAI Requirement)
I. Must be declared at the strain level
II. Must not be less than 10^8 CFU/g or ml unless specified otherwise
III. Requires prior approval from the Food Authority based on evidence
IV. Mandatory if not recommended for pediatric use
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-I, R-IV, S-III
(C) P-II, Q-IV, R-I, S-III
(D) P-III, Q-I, R-IV, S-II

82. Which of the following is NOT considered a barrier to the survival of probiotics during gastric transit?
(A) High levels of secretory IgA
(B) Extremely low pH
(C) Presence of pepsin
(D) Mechanical churning of the stomach

83. A regulatory food safety officer inspects a product labeled "Probiotic Yogurt". The label claims "Cures inflammatory bowel disease" but lists the active culture only as "Lactobacillus". Based on FSSAI guidelines, what are the primary compliance failures?
(A) The utilization of the protected word 'Yogurt' alongside live cultures
(B) Stating a specific functional health benefit without adding prebiotics
(C) Making a cure claim and failing to declare the probiotic at strain level
(D) Retailing a commercial probiotic yogurt without a companion antibiotic

84. Given below are two statements about the ICMR-DBT guidelines for probiotics:
Statement I: The guidelines mandate that probiotic strains must undergo in vitro tests for acid and bile tolerance.
Statement II: Human trials are strictly forbidden for proving the efficacy of new probiotic strains in India.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

85. Identify the correctly matched pair regarding microbial applications.
(A) Sourdough starter – Composed of pathologically active Enterobacteriaceae
(B) Kombucha – Fermented exclusively by strict, high-affinity obligate anaerobes
(C) Kefir grains – Symbiotic bacteria and yeast in a polysaccharide matrix
(D) Tempeh – Produced via liquid submerged fermentation utilizing Spirulina

NODIA

86. A dairy company wants to formulate a probiotic cheese. Since cheese ripening involves extended time and potentially low moisture and high salt, what is the best strategy for probiotic incorporation?
(A) Surface spraying the finished cheese with vegetative probiotic cells post maturation
(B) Incorporating microencapsulated probiotics into the matrix during curd formation
(C) Fermenting the cheese matrix at exactly 50 degrees to enhance probiotic growth
(D) Adding therapeutic doses of broad-spectrum antibiotics to prevent competition

87. Identify the incorrect pair regarding substrates and SCP microorganisms.
(A) Starch – Endomycopsis fibuligera
(B) Cellulose – Trichoderma viride
(C) N-alkanes – Yarrowia lipolytica
(D) Whey – Spirulina platensis

88. If a patient suffers from severe lactose intolerance, which specific microbial mechanism provided by live yogurt cultures helps alleviate the symptoms?

(A) Production of active beta-galactosidase which digests lactose in the gut
(B) Sustained cellular secretion of massive levels of physiological bile salts
(C) Rapid biochemical conversion of lactose into toxic biogenic amine compounds
(D) Complete physiological suppression of the host's entire digestive immunity

89. Which of the following statements concerning prebiotics is correct?
(A) They must be completely hydrolyzed and absorbed in the stomach to be effective.
(B) They are composed of highly viable dormant fungal spore preparations.
(C) They selectively alter the composition and activity of the gut microflora.
(D) They are fully synonymous with all types of insoluble dietary fiber like lignin.

90. What is the most appropriate reason why Bifidobacterium species are frequently paired with Fructooligosaccharides (FOS) in synbiotic formulations?
(A) Bifidobacterium possess specific enzymes (like beta-fructofuranosidases) to ferment FOS.
(B) FOS undergoes rapid chemical oxidation, yielding high dissolved oxygen levels in the colon.
(C) FOS completely inhibits competing lactic acid bacteria, allowing Bifidobacterium survival.
(D) FOS structures form a protective physical gel that shields the bacteria from gastric acid.

91. Which of the following genera belongs to Lactic Acid Bacteria (LAB) but is characterized by a rod shape and can be homo- or heterofermentative?
(A) Pediococcus group
(B) Leuconostoc group
(C) Lactococcus species
(D) Lactobacillus

92. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Yeasts are essential in the production of bread.
Reason (R): They produce lactic acid, which causes the dough to rise by trapping air bubbles.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

93. What is the definition of "competitive exclusion" in the context of probiotics?
(A) The biological process by which prebiotics actively exclude probiotics from the gut
(B) The physiological ability of probiotics to exclude vital vitamins from host absorption
(C) The physical blocking of mucosal pathogen adhesion sites by probiotic cells
(D) The rapid, high-frequency genetic mutation of probiotics to kill host somatic cells

94. Consider the following characteristics of a beneficial mold:
I. It produces a dense white mycelium.
II. It is used in surface-ripened cheeses.
III. It releases proteases and lipases that soften the cheese.
IV. It is known to produce the mycotoxin ochratoxin A in cheese.
Which of these characteristics apply to Penicillium camemberti?
(A) I, II and III only
(B) II, III and IV only
(C) I, III and IV only
(D) I, II and III only

95. Identify the incorrect statement regarding Bifidobacterium.
(A) It produces equal amounts of lactic acid, ethanol, and CO_2.
(B) It is a major microbial constituent of gut flora in breast-fed infants.
(C) It ferments dietary carbohydrates via the unique bifid shunt pathway.
(D) It is classified strictly as an anaerobic, Gram-positive bacterium.

96. Match the beneficial microorganism (List I) with its typical morphological characteristic (List II).
List I: (Microorganism)
P. Saccharomyces cerevisiae
Q. Lactobacillus acidophilus
R. Aspergillus niger
S. Streptococcus thermophilus
List II: (Morphological Characteristic)
I. Gram-positive cocci in chains
II. Non-motile, Gram-positive rods

Downloaded from www.pdf.tube

III. Unicellular eukaryote reproducing by budding
IV. Filamentous fungi with conidial heads
(A) P-II, Q-III, R-I, S-IV
(B) P-III, Q-II, R-IV, S-I
(C) P-IV, Q-I, R-II, S-III
(D) P-III, Q-IV, R-I, S-II

97. Which of the following is NOT an advantage of consuming Single Cell Protein (SCP)?
(A) It provides a concentrated source of high-quality protein.
(B) It inherently lacks any nucleic acids, requiring no processing.
(C) It can be produced year-round independent of climate.
(D) It can utilize waste streams, promoting environmental sustainability.

98. A food processor wants to produce a probiotic beverage using a strain of Lactobacillus casei. To ensure a minimum shelf-life of 30 days at 4°C with a viable count of 10^7 CFU/ml, which of the following is the most critical parameter to monitor?
(A) Post-acidification dropping pH below the strain's tolerance
(B) Environmental light exposure causing degradation of food colorings
(C) Spontaneous carbonation from complete homofermentative pathways
(D) Complete depletion of lactose sugar fractions in the formulation

99. Given below are two statements about starter cultures:
Statement I: Thermophilic starter cultures are used for yogurt and hard cheeses because their optimum growth temperature is between 40-45°C.
Statement II: Mesophilic starter cultures are used for sour cream and soft cheeses with an optimum growth temperature of 20-30°C.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

100. Identify the correctly matched pair regarding yeast metabolism.
(A) Aerobic respiration – Yields massive commercial quantities of industrial ethanol
(B) Anaerobic fermentation – Yields extremely high amounts of cellular ATP
(C) Invertase enzyme – Synthesizes pure sucrose complexes from glucose and fructose
(D) Zymase enzyme complex – Catalyzes fermentation of sugars to ethanol and CO_2

101. During the production of a fermented milk product, bacteriophages attack the primary acid-producing Lactococcus strain. The vat fails to acidify, but a secondary flavor-producing Leuconostoc strain survives. What will be the sensory result?
(A) High titratable acidity levels with absolutely no sensory flavor profiles
(B) A highly carbonated, effervescent, and extremely acidic finished cheese product
(C) Sweet, unfermented milk with potential contaminant off-flavors and low acidity
(D) Immediate enzymatic coagulation resulting in rapid, perfect curd structures

NODIA

102. Identify the incorrect pair regarding prebiotic mechanisms.
(A) Fermentation location – Primarily the proximal colon
(B) Effect on gut pH – Raises pH to highly alkaline levels
(C) Primary utilizers – Bifidobacteria and Lactobacilli
(D) End products – Short-chain fatty acids (acetate, propionate, butyrate)

103. In formulating a new synbiotic product aimed at maximizing the viability of Bifidobacterium longum, a scientist decides to use an extruded biopolymer matrix containing inulin. What is the fundamental principle applied here?
(A) Thermal destruction of vegetative cells to form spores
(B) Osmotic shock therapy combined with mild cold stress
(C) Chemical sterilization of the probiotic strain cultures
(D) Microencapsulation with co-delivery of a prebiotic

104. Which of the following statements correctly describes a quality standard for probiotic products in India as per FSSAI?
(A) The strain must be safe for humans with documented strain-specific benefits.
(B) Probiotics can legally contain up to 10^3 CFU/g of pathogenic E. coli strains.
(C) Products can claim probiotic status even if the cells are completely heat-killed.
(D) Prebiotics must constitute at least 50% of total product weight to be legally sold.

105. What is the most appropriate health claim that can be scientifically supported for well-documented probiotic strains like Lacticaseibacillus rhamnosus GG?
(A) Guarantees total 100% prevention of all gut viral infections
(B) Completely cures genetic lactose intolerance permanently
(C) Helps reduce the duration of acute infectious diarrhea
(D) Substitutes the clinical need for childhood vaccinations

106. Which of the following microorganisms is primarily cultivated in open raceway ponds due to its ability to thrive at high pH (alkaline conditions)?
(A) Spirulina
(B) Candida utilis
(C) Fusarium venenatum
(D) Saccharomyces cerevisiae

107. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Propionibacterium freudenreichii is crucial in the manufacture of Swiss cheese.
Reason (R): It ferments lactic acid to produce propionic acid, acetic acid, and carbon dioxide, which forms the characteristic 'eyes'.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

108. What is "diacetyl" in the context of food microbiology?
(A) A highly toxic volatile metabolic byproduct of commercial yeast fermentation
(B) A buttery flavor compound produced by certain lactic acid bacteria
(C) A strong clinical antimicrobial antibiotic secreted by Penicillium species
(D) A synthetic oligosaccharide prebiotic utilised in commercial yogurts

109. Consider the following about the genus Penicillium:
I. It is responsible for the ripening of Roquefort cheese.
II. It is entirely anaerobic.
III. It can produce potent antibiotics.
IV. It produces black conidiospores.
Which of the statements given above are correct?
(A) II, III and IV only
(B) I, II and IV only
(C) I and III only
(D) I, III and IV only

110. Identify the incorrect statement regarding the application of molds in the food industry.
(A) Molds are obligate aerobes; therefore, mold-ripened cheeses require surface exposure or piercing.
(B) Aspergillus oryzae is widely used for producing amylases and proteases in Koji preparation.
(C) Rhizopus oligosporus ferments soybeans to produce tempeh.
(D) Molds are extensively used to produce lactic acid as a primary fermentation product in dairy.

111. Match the SCFA (Short-Chain Fatty Acid) produced by prebiotic fermentation (List I) with its primary physiological role (List II).
List I: (SCFA)
P. Butyrate
Q. Propionate
R. Acetate
List II: (Physiological Role)
I. Major energy source for colonocytes; anti-inflammatory
II. Reaches the liver and participates in gluconeogenesis; lowers cholesterol
III. Most abundant SCFA in blood; crosses blood-brain barrier
(A) P-I, Q-II, R-III
(B) P-II, Q-III, R-I
(C) P-III, Q-I, R-II
(D) P-I, Q-III, R-II

Click Here to Buy book on Amazon

112. Which of the following is NOT an established characteristic of an ideal probiotic microorganism?
(A) Ability to adhere to intestinal epithelium
(B) Ability to synthesize systemic toxins
(C) Tolerance to stomach acid and bile salts
(D) Capacity to modulate host immune response

113. A food safety officer is reviewing a new "Probiotic Chocolate". The manufacturer states the chocolate contains 10^9 CFU/g of Bacillus coagulans spores. Why might a spore-forming bacterium be chosen for this specific delivery matrix?
(A) Spores are obligate anaerobes that require high fat environments to survive.
(B) Spores resist heat, mechanical stress, and low moisture during processing.
(C) Spores actively ferment lipid fractions during storage to improve chocolate flavor.
(D) Spores are the exclusive microbial form permitted by FSSAI in confectionery.

114. Given below are two statements about probiotic regulations in India:
Statement I: Probiotic foods are regulated under the Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food) Regulations, 2016.
Statement II: FSSAI mandates that all probiotic foods must be strictly sold as pharmaceutical drugs.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

115. Identify the correctly matched pair regarding lactic acid bacteria (LAB) classification.
(A) Obligate heterofermenters – Ferment glucose exclusively via the EMP pathway
(B) Facultative heterofermenters – Cannot ferment pentoses under any condition
(C) Obligate homofermenters – Possess aldolase but lack phosphoketolase
(D) Lactococcus – Exclusively heterofermentative

116. A batch of commercial yogurt turns out extremely bitter and displays excessive whey separation (syneresis). Which of the following processing or microbial factors is most likely responsible?
(A) Insufficient incubation times and inadequate acid development leading to high pH
(B) Routine commercial utilization of a strictly homofermentative lactic starter culture
(C) Complete absence of prebiotic oligosaccharide addition to the initial formulation
(D) Excessive acidification and proteolysis by L. bulgaricus at high temperature

117. Identify the incorrect pair regarding the nutritional value of Single Cell Protein (SCP).
(A) Microalgae (e.g., Spirulina) – High in protein and beta-carotene
(B) Yeast (e.g., Candida) – Excellent source of B-complex vitamins
(C) Mycoprotein (e.g., Quorn) – High in saturated fat and zero fiber
(D) Bacterial SCP – Generally has highest protein content among SCPs

118. In the production of a novel probiotic oat milk, the technologist incorporates β-glucan along with a Lactobacillus strain. What functional role does the β-glucan serve in this formulation?
(A) It acts strictly as a chemical preservative agent to suppress contaminant yeast growth.
(B) It acts as a prebiotic substrate, boosting probiotic survival and colonization.
(C) It functions to artificially color the plant-based milk to mimic dairy beverages.
(D) It rapidly decreases the medium pH to 2.0 before the fermentation process begins.

119. Which of the following statements about Synbiotics is correct?
(A) Synbiotics represent highly incompatible combinations of two or more distinct probiotic strains.
(B) Synbiotics are strictly complex chemical compounds synthesized under laboratory conditions.
(C) Synbiotics must be administered intravenously to achieve any therapeutic clinical effect.
(D) The prebiotic is designed to selectively stimulate the co-administered probiotic strain.

NODIA

120. What is the most appropriate reason why Bifidobacteria are rarely used alone as a traditional starter culture for dairy fermentation, despite being excellent probiotics?
(A) They are anaerobes that grow slowly in milk without growth promoters.
(B) They produce highly lethal clinical endotoxins during milk fermentation.
(C) They are strictly obligate aerobes that cause rapid surface spoilage.
(D) They biochemically convert lactose entirely into toxic biogenic amines.

121. What is the definition of the term "Microbiome"?
(A) Only the pathogenic bacterial populations currently present within a specific environment
(B) The isolated, purified genomic DNA sequence belonging to a single bacterial species
(C) The entire habitat: the microbes, their genomes, and the environmental conditions
(D) The biological tissues comprising the physical lining of the host intestinal tract

122. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Inulin is highly soluble in hot water and can form a gel network upon cooling.
Reason (R): This property allows inulin to be used as a fat replacer in various low-fat dairy products while simultaneously acting as a prebiotic.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

123. What precisely is a "Direct Vat Set" (DVS) or "Direct Vat Inoculation" (DVI) starter culture?
(A) A culture that must be subcultured multiple times in mother vats before use
(B) A raw liquid starter culture prepared directly from unpasteurized farm milk
(C) A synthetic chemical acidulant added directly to the vat to bypass fermentation
(D) A concentrated culture designed to be added directly to the production vat

124. Consider the following statements about the survivability of probiotics:
I. Freeze-drying is a common preservation method, though it induces osmotic and cold shock.
II. Cryoprotectants like skim milk powder or trehalose improve survival during freeze-drying.
III. Spray drying is rarely used for probiotics because the extreme heat inevitably kills 100% of cells.
IV. Encapsulation in alginate hydrogels protects probiotics from low gastric pH.
Which of the statements given above are correct?
(A) II, III and IV only
(B) I, II and IV only
(C) I, II and III only
(D) I, III and IV only

125. Identify the incorrect statement regarding the health effects of beneficial microorganisms.
(A) The gut microbiome composition can influence host metabolism and immune system development.
(B) Regular intake of certain probiotics can reduce the severity of atopic dermatitis in children.`
(C) Probiotics must colonize the gut permanently to exert any health benefits.
(D) Prebiotics naturally occur in foods like onions, garlic, asparagus, and bananas.

126. Match the food product (List I) with its predominant beneficial fermenting microorganism (List II).
List I: (Food Product)
P. Soy Sauce
Q. Sourdough bread
R. Kefir
S. Swiss Cheese
List II: (Fermenting Microorganism)
I. Propionibacterium freudenreichii
II. Aspergillus oryzae
III. Candida milleri and Lactobacillus sanfranciscensis
IV. Lactic acid bacteria and yeast symbiotic matrix (Kefiran)
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-IV, R-III, S-I
(C) P-III, Q-I, R-II, S-IV
(D) P-II, Q-III, R-IV, S-I

127. Which of the following substrates is NOT typically used for the industrial production of Single Cell Protein (SCP)?

Downloaded from www.pdf.tube

(A) Refined sucrose
(B) Sugarcane molasses
(C) Acid or sweet whey
(D) Sulphite liquor

128. When establishing the quality standards for a probiotic product, the viability of the strain must be maintained throughout its shelf life. If the decay rate of a probiotic is $1 \log_{10}$ reduction per month, and the required shelf life is 3 months with a minimum claim of 1×10^7 CFU/g, what must be the minimum initial inoculum at manufacturing?
(A) 1.0×10^8 CFU/g
(B) 1×10^{10} CFU/g
(C) 1.0×10^7 CFU/g
(D) 3.0×10^7 CFU/g

129. Given below are two statements regarding the production of Quorn:
Statement I: It is produced continuously using Fusarium venenatum in an airlift fermenter.
Statement II: After fermentation, the biomass is subjected to a heating step to reduce RNA content to safe levels.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

130. Identify the correctly matched pair regarding factors affecting gut microbiota.
(A) High-fiber diet – Increases SCFA-producing bacteria
(B) Antibiotic usage – Promotes microbial diversity and health
(C) Exclusive formula feeding in infants – Enriches exclusively for Bifidobacteria
(D) Aging – Dramatically increases the ratio of beneficial Bifidobacteria

131. A patient with recurrent Clostridioides difficile infection is recommended a specific therapy to restore their gut microbiome. Which of the following approaches is increasingly recognized in emerging research for this exact condition?
(A) Inducing total gut sterility with heavy metals
(B) Consumption of large quantities of synthetic amino acids
(C) Fecal Microbiota Transplantation (FMT)
(D) Complete avoidance of all dietary fiber

132. Identify the incorrect pair regarding the regulatory labelling of probiotics in India.
(A) "Probiotic Food" – Must be clearly declared on the commercial product label
(B) Best Before date – Absolutely mandatory on all retail probiotic products
(C) Health claims – Strictly regulated and require scientific substantiation
(D) Storage conditions – Optional; probiotics survive at any temperature

133. If a probiotic preparation claims to contain 5×10^9 CFU per capsule, how is this metric (CFU) best described in evaluating product quality?
(A) It represents the combined total number of both dead and live bacterial cells.
(B) It represents the precise physical mass of the probiotic strain in grams.
(C) It represents Colony Forming Units, indicating viable, culturable cells.
(D) It measures the total active intracellular enzymatic activity of the cells.

134. Which of the following statements correctly differentiates between homofermentative and heterofermentative Lactic Acid Bacteria (LAB)?
(A) Homofermentative LAB produce carbon dioxide gas during growth, whereas heterofermentative strains do not.
(B) Homofermentative LAB yield only lactic acid, while heterofermentative yield lactic acid, ethanol, and CO_2.
(C) Homofermentative LAB rely strictly on the phosphoketolase pathway, whereas heterofermentative use EMP.
(D) Homofermentative LAB are strictly classified as pathogenic, while heterofermentative are entirely beneficial.

NODIA

135. What is the most appropriate term for the metabolic interaction where one bacterial species utilizes the metabolic end-products of another species, a process highly relevant in gut microbiota and synbiotics?
(A) Competitive exclusion mechanism
(B) Host-parasite interaction
(C) Direct chemical antagonism
(D) Cross-feeding (Syntrophy)

136. Which of the following is the main commercial application of the yeast Kluyveromyces lactis?
(A) Production of lactase enzyme for lactose-free milk
(B) Bread leavening and dough conditioning in bakeries
(C) Primary yeast fermentation of commercial lager beers
(D) Industrial-scale commercial production of citric acid

137. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The viability of probiotics in fermented dairy products often decreases rapidly post-fermentation.
Reason (R): The continuous production of lactic acid during refrigeration (post-acidification) lowers the pH to levels that are stressful or lethal to probiotic strains.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

138. What is the definition of "Bacteriocins" in the context of lactic acid bacteria?
(A) Ribosomally synthesized bacterial peptides that inhibit related species
(B) Broad-spectrum secondary antibiotic compounds synthesized naturally by molds
(C) Toxic secondary chemical metabolites released into water systems by algae
(D) Specialized active enzymes that rapidly catalyze degradation of milk fats

139. Consider the following steps in commercial yogurt starter preparation:
I. Selection of non-phage-sensitive strains
II. Culturing S. thermophilus and L. bulgaricus in separate vessels
III. Blending the two strains to achieve the desired rod-to-coccus ratio
IV. Autoclaving the final blend to ensure sterility before packaging
Which of the statements given above are acceptable practices?
(A) II, III and IV only
(B) I and III only
(C) I, II, III and IV
(D) I, II and III only

140. Identify the incorrect statement regarding the application of molds in foods.
(A) Fungi are generally more tolerant of low water activity (a_w) than bacteria.
(B) All Aspergillus species are universally recognized as GRAS and completely safe for food use.
(C) Molds are typically used in the production of fermented meats like salami (e.g., Penicillium nalgiovense).
(D) Molds contribute to flavor development via intense proteolytic and lipolytic activity.

141. Match the fermentation process (List I) with the predominant end product (List II).
List I: (Fermentation Process)
P. Homofermentative LAB
Q. Saccharomyces cerevisiae in dough
R. Propionibacterium in cheese
S. Acetobacter in wine
List II: (Predominant End Product)
I. Ethanol and CO_2
II. Propionic acid, acetic acid, and CO_2
III. Acetic acid
IV. Primarily Lactic acid
(A) P-I, Q-IV, R-III, S-II
(B) P-IV, Q-II, R-I, S-III
(C) P-IV, Q-I, R-II, S-III
(D) P-III, Q-I, R-II, S-IV

142. Which of the following is NOT an established mechanism by which prebiotics exert their beneficial effects?
(A) Increasing fecal biomass and improving bowel habits
(B) Selective stimulation of beneficial Bifidobacteria
(C) Production of physiological short-chain fatty acids
(D) Direct binding of toxic heavy metals in the stomach

143. A food manufacturer wishes to claim that their new beverage "Modulates the gut immune system". Under FSSAI guidelines for functional foods and probiotics, what is mandatory to make this claim?
(A) The claim must have robust human clinical trials and FSSAI panel approval.
(B) Only a simple and basic literature review compiled from academic textbooks

Click Here to Buy book on Amazon

(C) Utilizing any generic strain of Lactobacillus without conducting novel trials
(D) No official regulatory approval is required if containing natural fruit juice

144. Given below are two statements about Single Cell Protein:
Statement I: The protein quality of SCP is often measured by its Biological Value (BV) and Protein Efficiency Ratio (PER).
Statement II: SCP typically lacks essential vitamins, requiring extensive artificial fortification before use.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct and Statement II is incorrect.
(D) Statement I is incorrect and Statement II is correct.

145. Identify the correctly matched pair regarding starter culture forms.
(A) Liquid starters – Highly stable, can be stored for years at room temperature
(B) Lyophilized cultures – Water is removed via sublimation under vacuum to induce dormancy
(C) Deep-frozen cultures – Kept at -20°C without any cryoprotectants
(D) Mother cultures – The final large volume of culture used directly in a 10,000 L vat

146. A consumer complains that a commercial probiotic dairy drink has "bulged" and is effervescent. The label indicates it contains Lactobacillus acidophilus and Bifidobacterium animalis. Neither of these are gas producers. What is the most likely cause?
(A) Contamination with heterofermentative LAB, coliforms, or yeasts
(B) Natural cellular metabolism of stated probiotics at room temperature
(C) Spontaneous chemical breakdown of raw lactose into gaseous oxygen
(D) Formulating with inulin, which spontaneously generates gas in liquids

147. Identify the incorrect pair regarding health benefits and specific strains.
(A) Saccharomyces boulardii – Prevention of antibiotic-associated diarrhea
(B) Lactobacillus rhamnosus GG – Reduction in risk of rotavirus diarrhea
(C) Streptococcus pyogenes – Routine probiotic used for immune boosting
(D) Bifidobacterium infantis – Alleviation of IBS symptoms

148. In optimizing the survival of probiotics during industrial spray drying, a technologist decides to apply a "sub-lethal heat shock" to the culture prior to drying. Why is this applied?
(A) To partially sterilize the initial probiotic culture to prevent accidental contamination
(B) To permanently denature external cell wall protein structures for easier host digestion
(C) To artificially raise cellular water activity levels prior to high-temperature spray drying
(D) To induce heat-shock proteins (HSPs) providing tolerance to subsequent thermal stress

149. Which of the following statements about the regulatory status of prebiotics in India is correct?
(A) Any dietary fiber can be legally designated as a prebiotic without scientific validation.
(B) Prebiotics are completely banned by regulatory bodies in infant formula food substitutes.
(C) FSSAI maintains an approved list of prebiotics (like Inulin, FOS) with defined limits.
(D) Prebiotics must be declared as synthetic food additives under Class II preservative codes.

150. What is the most appropriate term used in emerging microbiome research to describe an imbalance or disruption in the normal, healthy composition of the gut microbiota?
(A) Homeostasis
(B) Dysbiosis
(C) Eubiosis
(D) Symbiosis

www.nodia.in

Downloaded from www.pdf.tube

ANSWERS

1. (B) To drive biochemical changes that enhance shelf-life, texture, and flavor
Beneficial microorganisms play a crucial role in commercial food production by driving key biochemical processes such as fermentation. These transformations significantly improve the sensory attributes of food, including its texture and flavor, while also producing natural preserving agents like organic acids and bacteriocins that extend shelf life and prevent the proliferation of undesirable spoilage organisms.

2. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Generally Recognized as Safe status is awarded to food-grade microorganisms with a documented history of safety. These selected beneficial strains are classified under this category because they have been proven safe through long-term traditional use, showing no evidence of toxicity, pathogenicity, or ability to cause infections in healthy human populations under standard dietary consumption conditions.

3. (C) A defined formulation of live microbes added to initiate fermentation
Starter cultures are specific, defined preparations of live microorganisms that are deliberately inoculated into food raw materials. This controlled addition ensures a rapid, predictable, and efficient fermentation process, guiding the biochemical pathways to achieve consistent product quality, acidity, texture, and flavor, while minimizing the risks associated with unpredictable wild microbial fermentations.

4. (D) I, II and IV only
Production of industrial starter cultures requires maintaining aseptic mother cultures to avoid contamination. These are scaled up to bulk starters for direct inoculation into production vats. Lyophilization is a common preservation method, and cryoprotectants are essential during deep-freezing to preserve cell viability by preventing ice crystal damage to the microbial cell membranes.

5. (C) Regular subculturing in liquid media is the preferred method for long-term genetic stability.
Regular subculturing of starter cultures in liquid media is highly discouraged for long-term preservation because it increases the risk of contamination, cellular mutation, and loss of critical technological properties. Instead, methods like freeze-drying or cryogenic storage in liquid nitrogen are preferred as they effectively maintain genetic stability by keeping the microorganisms in a dormant state.

6. (B) P-II, Q-IV, R-III, S-I
Liquid starter preparations have a short shelf life and require continuous subculturing. Lyophilized cultures are freeze-dried powders requiring reactivation. Deep-frozen starters are preserved at cryogenic temperatures around minus one hundred ninety-six degrees Celsius. Direct Vat Set cultures are highly concentrated preparations designed to inoculate production vats directly without any intermediate scaling-up steps.

NODIA

7. (D) High susceptibility to bacteriophage attack
Ideal dairy starter cultures must possess predictable acid production rates, appropriate metabolic pathways, and flavor-producing abilities. However, susceptibility to bacteriophages is a severe operational hazard that halts fermentation and causes batch failure. Industrial strains are specifically selected or genetically developed for their high resistance to phage infections to ensure consistent and reliable processing.

8. (A) II, IV, III, I
Traditional propagation of dairy cultures starts with activating the preserved mother culture. This active culture is scaled up through an intermediate culture stage to increase cell numbers. Subsequently, the bulk starter is prepared to provide sufficient volume for the final step, which involves inoculating the large-volume industrial production vat to initiate fermentation.

9. (D) Statement I is incorrect and Statement II is correct.
Lactic Acid Bacteria are Gram-positive, non-spore-forming, but they are aerotolerant anaerobes or microaerophilic, not strictly aerobic. These

bacteria obtain their cellular energy primarily through the fermentation of carbohydrates, where lactic acid is synthesized as the major metabolic end-product, significantly lowering the pH of the food matrix to preserve and flavor it.

10. (A) Streptococcus thermophilus – Commonly paired with Lactobacillus bulgaricus in yogurt
Yogurt manufacturing relies on a symbiotic relationship between Streptococcus thermophilus and Lactobacillus bulgaricus. These two lactic acid bacteria stimulate each other through proto-cooperation, enhancing acid development and flavor compound production. Homofermentative species produce only lactic acid, while heterofermentative strains use the phosphoketolase pathway to yield lactic acid, carbon dioxide, and ethanol.

11. (D) Infection of the starter culture by virulent host bacteriophages
A sudden and complete cessation of acid production during commercial dairy fermentation is typically caused by bacteriophage infection. Virulent phages specifically infect and lyse the starter culture cells, such as Lactococcus lactis, halting their metabolic activities abruptly. This results in an unfermented batch with high pH, causing significant economic losses in commercial cheese processing operations.

12. (B) Leuconostoc – Obligate heterofermentative, produces no gas
Members of the genus Leuconostoc are characteristically obligate heterofermentative lactic acid bacteria. They utilize the phosphoketolase pathway for carbohydrate fermentation, which inherently yields significant amounts of carbon dioxide gas, ethanol, and acetic acid alongside lactic acid. Therefore, describing this genus as a group that produces no gas during its metabolic activity is incorrect.

13. (C) Phosphoketolase pathway
Fermented vegetable products requiring significant gas production for sensory characteristics rely on heterofermentative lactic acid bacteria. These organisms metabolize hexoses using the phosphoketolase pathway instead of the Embden-Meyerhof-Parnas pathway. This specific metabolic route yields equal molar amounts of lactic acid, ethanol or acetate, and carbon dioxide gas, which provides the desired effervescence.

14. (D) Bacteriocin production, such as nisin by Lactococcus lactis, inhibits Gram-positive pathogens.
Lactic acid bacteria generate ATP through substrate-level phosphorylation, not oxidative phosphorylation, yielding one mole of ATP per mole of glucose in heterofermentation. These bacteria are widely used across diverse dairy and vegetable matrices. They produce bacteriocins, such as nisin synthesized by Lactococcus lactis, which act as natural antimicrobial peptides that inhibit closely related Gram-positive foodborne pathogens.

15. (A) Suppression of pathogenic and spoilage microorganisms
Rapid acidification of the food matrix by starter cultures is a primary preservation mechanism. The rapid decrease in pH, caused by the accumulation of lactic acid, creates an extremely hostile environment for most pathogenic and spoilage bacteria. This acidity, combined with competition for nutrients, effectively suppresses undesirable microbial growth, ensuring the safety of fermented foods.

16. (B) Its rapid alcoholic fermentation in dough yielding carbon dioxide
Saccharomyces cerevisiae is highly effective in baking due to its robust ability to perform alcoholic fermentation under the anaerobic conditions of bread dough. This metabolic activity converts fermentable sugars into ethanol and carbon dioxide gas. The trapped carbon dioxide gas expands within the gluten matrix, causing the dough to rise and creating the characteristic porous crumb.

17. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Saccharomyces cerevisiae exhibits the Crabtree effect, which is a physiological phenomenon where the yeast favors aerobic fermentation over respiration when glucose levels are high. Even in the presence of oxygen, high concentrations of glucose repress the respiratory enzymes, leading to the production of ethanol and carbon dioxide instead of complete oxidation of sugars to water.

18. (A) Strains of Saccharomyces cerevisiae selected for rapid leavening and CO_2 yield
Baker's yeast refers to specific commercial strains of the yeast Saccharomyces cerevisiae that have been carefully selected for industrial baking.

Click Here to Buy book on Amazon

product packaging has high oxygen permeability, dissolved oxygen levels rise, which, combined with the low pH of post-acidified yogurt, rapidly kills the sensitive cells.

57. (C) Pepsin – A proteolytic enzyme that enhances probiotic membrane integrity
Low gastric pH and bile salts present major physiological challenges that stress and disrupt bacterial cells. Pancreatin in the duodenum also acts as a chemical hurdle. Pepsin is a powerful proteolytic enzyme in the stomach that degrades proteins, which typically damages bacterial cell wall proteins rather than enhancing the membrane integrity of probiotic strains.

58. (A) Microencapsulation using sodium alginate and calcium chloride
Incorporating probiotic bacteria into highly acidic food matrices like fruit juice often leads to rapid cell death. To improve survival, the most effective strategy is microencapsulation using biocompatible hydrogels like sodium alginate cross-linked with calcium chloride. This physical barrier protects the cells from the direct toxic effects of organic acids in the juice.

59. (D) Sublethal stress pre-treatment enhances subsequent tolerance to harsh conditions.
Probiotic bacteria are highly sensitive to industrial processing. Subjecting these cells to mild, sublethal stress treatments—such as heat shock, osmotic stress, or mild acidification—prior to processing induces the expression of protective stress proteins. This physiological adaptation significantly enhances their subsequent survival during harsh dehydration processes like freeze-drying or spray drying.

60. (B) 10^6 - 10^7 CFU/g
To exert a demonstrable therapeutic or beneficial health effect on the host, probiotic food products must contain a sufficient concentration of viable cells at the time of consumption. International regulatory guidelines generally recommend a minimum viable probiotic count of ten to the power of six to seven colony forming units per gram.

61. (C) A selectively utilized substrate that confers a host health benefit
A prebiotic is defined as a substrate that is selectively utilized by host microorganisms, conferring a health benefit. Unlike probiotics, which are live cells, prebiotics are non-viable chemical compounds, typically non-digestible oligosaccharides. They escape digestion in the upper gastrointestinal tract and are specifically fermented by beneficial bacteria in the colon.

62. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Inulin and fructooligosaccharides are classic examples of functional prebiotics. Because of their unique chemical beta-linkages, they resist enzymatic hydrolysis by human salivary and pancreatic enzymes in the upper digestive tract. They arrive intact in the large intestine, where they are selectively fermented by beneficial bifidobacteria, promoting their growth and activity.

63. (A) Galactooligosaccharides
GOS stands for galactooligosaccharides, which are important prebiotic carbohydrates. They are composed of chains of galactose units with a terminal glucose molecule, typically produced industrially from lactose using the transgalactosylation activity of beta-galactosidase enzymes. GOS is highly stable and selectively stimulates the growth of beneficial Bifidobacteria and Lactobacilli in the gut.

64. (B) I, II and III only
Inulin, resistant starch, and fructooligosaccharides are classified as prebiotics. These complex carbohydrates resist digestion in the human small intestine and pass into the colon to serve as fermentable substrates for beneficial bacteria. In contrast, sucrose is a simple, highly digestible disaccharide that is rapidly absorbed in the upper digestive tract.

65. (B) Prebiotics are hydrolyzed by human salivary and pancreatic amylases.
Prebiotics are characterized by their complete resistance to hydrolysis by human digestive enzymes, including salivary and pancreatic amylases. This resistance allows them to pass through the stomach and small intestine entirely intact. Upon reaching the colon, they are selectively fermented by anaerobic bifidobacteria and lactobacilli, producing beneficial short-chain fatty acids.

66. (A) P-II, Q-I, R-III, S-IV
Inulin is a fructose polymer extracted from chicory roots. Galactooligosaccharides are

NODIA

28. (B) Water activity (a_w), temperature, and aeration
In solid-state fermentation of Aspergillus oryzae, controlling water activity, temperature, and aeration is critical. Proper moisture levels support vegetative mycelial growth and enzyme secretion while preventing premature sporulation. Adequate aeration supplies essential oxygen for this obligate aerobe and helps regulate metabolic heat, ensuring optimal yields of starch-degrading amylases rather than reproductive conidia.

29. (C) They are zygomycete molds that play a crucial role in producing tempeh.
Species within the genus Rhizopus are classified as zygomycete molds. These filamentous fungi are obligate aerobes that thrive on solid food surfaces. Rhizopus oligosporus is particularly famous for its essential role in tempeh production, where its rapidly growing hyphae penetrate and bind cooked soybeans into a compact, cohesive, and highly nutritious cake.

30. (D) Intense lipolysis releasing fatty acids that impart sharp flavors
During the ripening of blue-veined cheeses, Penicillium roqueforti secretes active lipolytic and proteolytic enzymes. The lipases hydrolyze milk lipids, releasing free fatty acids that are subsequently oxidized into methyl ketones and lactones. These volatile chemical compounds are directly responsible for the characteristic sharp, peppery flavor and aroma associated with blue cheeses.

31. (A) Streptococcus thermophilus
Yogurt production conventionally relies on a defined mixed starter culture containing two specific lactic acid bacteria: Streptococcus thermophilus and Lactobacillus delbrueckii subspecies bulgaricus. These two species grow in a symbiotic relationship, where their combined metabolic activity acidifies milk and produces key aroma compounds, such as acetaldehyde, much faster than either species could alone.

32. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Streptococcus thermophilus and Lactobacillus bulgaricus exhibit proto-cooperation during yogurt fermentation. S. thermophilus grows rapidly initially, producing formic acid, carbon dioxide, and purines that stimulate the growth of L. bulgaricus. In turn, the highly proteolytic L. bulgaricus cleaves milk proteins to release essential amino acids and peptides that promote the growth of S. thermophilus.

33. (B) Dried microbial cells used as protein supplements in food or animal feed
Single Cell Protein refers to the dehydrated, dead biomass of refined microorganisms, including bacteria, yeasts, filamentous fungi, or microalgae. This microbial biomass is cultivated on various cheap organic or inorganic substrates and processed for use as a high-protein nutritional supplement in human diets or as an alternative protein source in animal feed formulations.

34. (A) I, II and III only
Single Cell Protein can be produced using agricultural and industrial sub-products like molasses and whey. Lignocellulosic residues require pretreatment to liberate fermentable sugars. Some methylotrophic bacteria can use methane or methanol as carbon sources. Heavy metals are highly toxic contaminants and are strictly excluded from fermentation media to ensure safe biomass production.

35. (C) Its cultivation requires vast arable land and depends on seasonal climates.
Single Cell Protein production offers a massive advantage over traditional agriculture because it is carried out in closed bioreactors or controlled industrial fermenters. Consequently, this process does not require fertile arable land, is completely independent of seasonal weather conditions, and can be operated continuously year-round to yield high amounts of high-quality protein.

36. (D) P-III, Q-I, R-IV, S-II
Spirulina maxima is a photosynthetic cyanobacterium. Chlorella is a genus of single-celled green microalgae. Candida utilis, commonly known as torula yeast, is widely cultivated on sulfite liquors as high-protein fodder yeast. Fusarium venenatum is a filamentous microfungus utilized in pressurized airlift bioreactors to produce mycoprotein for human consumption under the brand name Quorn.

37. (C) Zero requirement for downstream processing or purification
Utilizing agro-industrial waste streams for Single Cell Protein production reduces environmental pollution by consuming high-BOD materials and converts low-value byproducts into valuable protein. However, downstream processing remains

Downloaded from www.pdf.tube

absolutely necessary. The raw microbial biomass must undergo harvesting, washing, cell disruption, nucleic acid reduction, and drying before it is safe or suitable for consumption.

38. (B) Harvesting → Washing → Nucleic acid reduction → Drying
Downstream processing of Single Cell Protein from liquid broth begins with harvesting the microbial cells using centrifugation or filtration. The collected biomass is washed to remove residual media. It then undergoes nucleic acid reduction, typically via heat shock, to lower RNA levels. Finally, the processed biomass is dried to produce a stable, storable powder.

39. (C) Statement I is correct and Statement II is incorrect.
Single Cell Protein is rich in essential amino acids, though it often contains lower concentrations of sulfur-containing amino acids. However, raw microbial biomass contains high levels of nucleic acids, primarily RNA. Consuming high levels of nucleic acids poses a serious health risk to humans, as it leads to elevated uric acid production and gout.

40. (A) Methylophilus methylotrophus – Methanol
Methylophilus methylotrophus is a specialized methylotrophic bacterium commercially cultivated using methanol as its sole carbon and energy source to produce bacterial Single Cell Protein. Saccharomyces cerevisiae is grown on carbohydrates like molasses. Spirulina requires carbon dioxide and light, while Candida lipolytica is known for utilizing liquid hydrocarbons or fats rather than carbon dioxide.

41. (C) Bioaccumulation of toxic heavy metals and organic pollutants in cells
Using uncharacterized industrial paper mill effluents for Single Cell Protein production poses a critical food safety hazard. Microorganisms can actively bioaccumulate toxic heavy metals and chlorinated organic compounds present in the effluent. If these toxic chemical contaminants accumulate in the microbial biomass, the resulting protein product becomes highly toxic and unsafe for consumption.

42. (A) Chlorella – Grown strictly in dark, anaerobic conditions
Chlorella is a genus of green microalgae that are photosynthetic autotrophs. To grow efficiently and produce biomass, they require light, carbon dioxide, and aerobic conditions, not dark, anaerobic environments. Spirulina thrives in highly alkaline lakes, Fusarium venenatum produces mycoprotein, and Candida utilis is versatile enough to assimilate pentose sugars from wood hydrolysates.

43. (D) Heat shock at 64-68°C to activate endogenous RNases
Fungal biomass with ten percent RNA is unsafe for direct human consumption. To reduce this nucleic acid content, the cell suspension is subjected to a rapid heat shock at sixty-four to sixty-eight degrees Celsius. This temperature inactivates cellular protein synthesis while activating endogenous ribonucleases, which degrade the RNA into soluble nucleotides that diffuse out.

44. (B) The mycoprotein structure imparts a fibrous, meat-like texture.
Quorn is a commercial food product derived from the non-pathogenic, filamentous microfungus Fusarium venenatum. The cellular biomass, or mycoprotein, naturally consists of long, branching hyphae. This physical, filamentous structure closely mimics the alignment of animal muscle fibers, imparting a desirable, chewy, and meat-like texture to the finished vegetarian meat analogues.

45. (C) Uric acid accumulation causing gout and kidney stones
High consumption of untreated Single Cell Protein leads to an excessive intake of nucleic acids, particularly RNA. Humans lack the active enzyme uricase, which breaks down uric acid into soluble allantoin. Consequently, the purines are metabolized into insoluble uric acid, which accumulates in the blood and crystallizes in joints and kidneys, causing gout.

46. (D) Fusarium venenatum
Fusarium venenatum is a soil-dwelling, non-pathogenic, filamentous fungus. It is the primary organism used to produce mycoprotein, the core ingredient in the highly successful commercial product range sold under the brand name Quorn. This fungus is grown in large-scale continuous airlift fermenters under sterile conditions to produce high yields of fibrous biomass.

NODIA

47. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
The World Health Organization recommends limiting daily dietary nucleic acid intake from Single Cell Protein to two grams. This restriction is necessary because humans do not possess the functional enzyme uricase. Without this enzyme, purine metabolism terminates at uric acid, which is highly insoluble and can deposit in joint tissues, causing painful clinical gout.

48. (B) Live microbes which, in adequate amounts, confer host health benefits
According to the official FAO and WHO definition, probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit on the host. This definition emphasizes that the organisms must be viable at the time of consumption and backed by scientific evidence demonstrating positive physiological effects within the host gastrointestinal tract.

49. (B) I, II and IV only
Essential selection criteria for probiotic strains include resistance to gastric acidity and bile salts, which ensures their survival during digestion. They must also possess the ability to adhere to the intestinal mucosa to colonize the gut. Most importantly, they must have proven safety and lack any transferable antibiotic resistance genes to avoid genetic transmission.

50. (A) Probiotics can completely cure all types of inflammatory bowel disease (IBD) within days.
Probiotics provide significant therapeutic support, such as reducing antibiotic-associated diarrhea, modulating immune function, and expressing beta-galactosidase to alleviate lactose intolerance. However, claiming that probiotics can completely cure complex, chronic inflammatory bowel diseases within a few days is medically incorrect and scientifically unsupported, as IBD management requires comprehensive, multi-faceted medical therapies.

51. (C) P-III, Q-IV, R-II, S-I
Lacticaseibacillus rhamnosus GG has extensive clinical evidence for treating pediatric rotavirus diarrhea. Bifidobacterium animalis improves bowel transit times and digestive regularity. Saccharomyces boulardii is a robust probiotic yeast highly effective at preventing antibiotic-associated diarrhea. Lactobacillus bulgaricus is a traditional starter culture with limited survival capacity in the human intestinal tract.

52. (D) Destruction of native microbiota to reset the immune system
Probiotics exert beneficial health effects through several mechanisms, including the secretion of antimicrobial bacteriocins, competitive exclusion of pathogens from mucosal binding sites, and strengthening the intestinal epithelial barrier. They work in harmony with the host's resident microorganisms and do not destroy or eliminate the native microbiota to reset the immune system.

53. (C) It requires protective delivery technologies to survive gastric transit
A candidate probiotic strain that demonstrates excellent in vitro health benefits but is sensitive to low pH and bile salts cannot survive stomach transit in a free state. To be utilized effectively in commercial products, it requires protective delivery technologies, such as microencapsulation, to shield the vegetative cells until they reach the intestine.

54. (C) Statement I is correct and Statement II is incorrect.
Fermented dairy products like yogurt are highly effective vehicles for delivering probiotic bacteria to the human gut. The proteins and fats in milk provide an excellent buffering capacity that protects the live probiotic cells from the highly acidic environment of the stomach, thereby significantly increasing their survival rates during gastric transit.

55. (D) Microencapsulation – Protects probiotic cells from harsh environment
Microencapsulation is a advanced technology where live probiotic cells are entrapped within protective polymer matrices, such as alginate or chitosan. This physical barrier effectively shields the sensitive microorganisms from harsh environmental conditions, including thermal processing, highly acidic gastric juices, and toxic bile secretions, ensuring high viable counts reach the lower intestine.

56. (A) High oxygen permeability of the packaging and low pH of the yogurt.
A rapid decline in the viability of Bifidobacterium in yogurt is typically caused by oxygen exposure and high acidity. Bifidobacteria are anaerobic organisms highly sensitive to oxygen. If the

Click Here to Buy book on Amazon

These strains are chosen for their rapid gas production, high viability in dough systems, rapid utilization of maltose and sucrose, and ability to generate significant volumes of carbon dioxide, which ensures efficient leavening of dough.

19. (C) I and III only
Kluyveromyces marxianus is a yeast species capable of fermenting lactose, unlike Saccharomyces cerevisiae which lacks lactase and cannot ferment lactose directly. Zygosaccharomyces rouxii is a highly osmophilic yeast essential for soy sauce fermentation under high salt conditions. Yeasts typically reproduce vegetatively through budding, although some species can reproduce by binary fission or sexual sporulation.

20. (D) Yeasts are generally responsible for the production of propionic acid in Swiss cheese.
Yeast extracts serve as premium flavor enhancers rich in nucleotides and amino acids, and Saccharomyces ellipsoideus is favored for wine fermentation. In industrial brewing, top-fermenting strains of Saccharomyces cerevisiae are utilized for ales. However, the production of propionic acid and carbon dioxide in Swiss cheese is driven by Propionibacterium species, not by yeasts.

21. (C) P-IV, Q-III, R-II, S-I
Saccharomyces cerevisiae is the standard yeast for ale brewing. Kluyveromyces lactis is an industrial source of the lactase enzyme due to its lactose-fermenting capabilities. Zygosaccharomyces bailii is a notorious spoilage organism in acidic, preservative-rich foods due to high resistance. Candida milleri is an acid-tolerant yeast that works symbiotically in traditional sourdough fermentations.

22. (B) Longer shelf-life at room temperature without loss of viability
Compressed fresh yeast contains high moisture, making it highly active, easy to disperse in dough, and capable of initiating rapid fermentation. However, this high moisture content makes it highly perishable and unstable at room temperature. Active dry yeast, having undergone dehydration, possesses a significantly longer shelf life and can be stored easily without refrigeration.

23. (D) II, III, I, IV
During baking, yeast first utilizes trapped oxygen for brief aerobic respiration. Once oxygen is depleted, anaerobic fermentation begins, starting with the consumption of simple endogenous sugars like glucose and fructose. After these are exhausted, yeast ferments maltose derived from starch breakdown, ultimately producing substantial amounts of carbon dioxide and ethanol to leaven the dough.

24. (D) Statement I is incorrect and Statement II is correct.
Traditional sourdough fermentation does not rely on pure commercial baker's yeast alone. Instead, it involves a complex, symbiotic microbial ecosystem comprising acid-tolerant yeasts, such as Candida milleri, and heterofermentative lactic acid bacteria, primarily Lactobacillus sanfranciscensis. This mutualistic relationship produces both the organic acids and carbon dioxide required for sourdough rising and flavor.

25. (C) Aspergillus oryzae – Production of soy sauce and sake
Aspergillus oryzae is a beneficial filamentous fungus crucial for preparing Koji, the first stage in producing soy sauce, miso, and sake. This mold secretes highly active amylases and proteases that hydrolyze complex starches and proteins into fermentable sugars and amino acids. Penicillium roqueforti ripens blue cheese, while Rhizopus oligosporus is used for tempeh.

NODIA

26. (A) The Koji preparation phase
The Koji phase is the initial solid-state fermentation of soy sauce production, where Aspergillus oryzae grows on cooked soybeans and wheat. This mold produces vital hydrolytic enzymes like proteases and amylases. Failure during this phase prevents the breakdown of raw proteins and starches, resulting in poor flavor and incomplete fermentation during the subsequent salty Moromi stage.

27. (D) Penicillium roqueforti – Produces aflatoxins in blue-veined cheese
Penicillium roqueforti is a non-pathogenic mold selected for blue cheese ripening, contributing unique flavors through lipolysis without producing harmful toxins. Aflatoxins are extremely toxic, carcinogenic compounds synthesized specifically by certain Aspergillus species, such as Aspergillus flavus and Aspergillus parasiticus, under improper storage conditions of grains and nuts, but never by Penicillium roqueforti.

synthesized enzymatically from lactose. Resistant starch escapes digestion in the small intestine and is abundant in green bananas. Lactulose is a synthetic disaccharide of galactose and fructose that functions as an effective prebiotic by stimulating beneficial lactic acid bacteria.

67. (C) Elevation of systemic blood glucose levels
Fermentation of prebiotics by gut bacteria yields short-chain fatty acids like acetate, propionate, and butyrate. These compounds lower luminal pH, provide critical energy for colonocytes, and enhance the absorption of minerals like calcium. They do not elevate systemic blood glucose; in fact, propionate helps regulate hepatic gluconeogenesis and improves insulin sensitivity.

68. (D) Synbiotic concept
The synbiotic concept refers to the synergistic combination of a live probiotic microorganism and a selective prebiotic substrate within a single product. This design ensures that the prebiotic specifically stimulates and supports the survival, growth, and metabolic activity of the co-administered probiotic strain during its transit through the host gastrointestinal tract.

69. (A) Both Statement I and Statement II are correct.
Synbiotics are classified into two categories. Complementary synbiotics combine probiotics and prebiotics that work independently to provide health benefits. In contrast, synergistic synbiotics are formulated so that the prebiotic compound is specifically chosen to be preferentially fermented by the co-administered probiotic strain, enhancing its survival and colonization in the colon.

70. (B) Acetate – A short-chain fatty acid produced by fermentation
Acetate is a major short-chain fatty acid produced during the microbial fermentation of prebiotic fibers in the colon. It is highly beneficial, entering the systemic circulation to act as an energy source for peripheral tissues. Butyrate is anti-inflammatory, hydrogen sulfide can be toxic at high levels, and lactic acid lowers gut pH.

71. (D) No, because a health benefit to the host is fundamentally required
To be classified as a true synbiotic under FAO and WHO guidelines, the formulation must demonstrate a clear, measurable health benefit to the host. Simply showing the proliferation of the probiotic strain in vivo is insufficient if it does not lead to positive physiological improvements, such as enhanced gut barrier function.

72. (A) Viable count – Not mandated; dead cells are classified as probiotics
FSSAI regulates health supplements and nutraceuticals in India, utilizing ICMR-DBT guidelines to evaluate probiotic foods. All health claims must be scientifically substantiated. However, stating that viable count is not mandated is incorrect; probiotics are defined as live microorganisms, and maintaining a high viable count throughout shelf life is a mandatory requirement.

NODIA

73. (C) Substitute FOS with a more heat-stable prebiotic like GOS
Fructooligosaccharides are susceptible to thermal hydrolysis in acidic aqueous environments, which degrades their prebiotic structure into simple sugars. To overcome this technological issue, the most appropriate solution is to substitute FOS with a more structurally robust, heat-stable and acid-tolerant prebiotic, such as galactooligosaccharides, which resists degradation during thermal pasteurization.

74. (A) The label must declare the specific strain of probiotics added.
FSSAI labeling regulations for probiotic foods require declaring the specific strain of the probiotic microorganism on the product packaging, rather than just the genus or species. The label must also display the minimum viable count, the "Best Before" date, and instructions for proper storage to ensure probiotic viability.

75. (D) Bidirectional signaling linking the enteric and central nervous systems
The gut-brain axis is a complex, bidirectional communication network that connects the central nervous system with the enteric nervous system of the gastrointestinal tract. This pathway involves direct neural connections, such as the vagus nerve, as well as endocrine, immune, and humoral signals, allowing the gut microbiota to influence brain function and behavior.

76. (B) Bifidobacterium bifidum
Bifidobacterium bifidum is a Gram-positive, non-spore-forming, anaerobic bacterium characterized by a distinct branched or Y-shaped rod morphology. It is a dominant and essential component of the

healthy gut microbiota in breast-fed infants and is widely utilized as a probiotic strain to support digestive health and immune system regulation.

77. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Regular consumption of specific probiotic strains enhances host immunity. This effect occurs because the live probiotic cells interact directly with immune cells in the gut-associated lymphoid tissue. This interaction stimulates the production of secretory immunoglobulin A and modulates cytokine secretion profiles, strengthening the gut mucosal barrier and regulating systemic immune responses.

78. (D) Preparation of inanimate microbes and components conferring a host health benefit
Postbiotics are officially defined as preparations of inanimate microorganisms and their components that confer a health benefit on the host. These products contain non-viable, heat-killed microbial cells, cell wall fragments, or metabolic byproducts like short-chain fatty acids and bacteriocins, offering a highly stable alternative to live probiotic formulations.

79. (A) I, II and III only
Fungal Single Cell Protein can occasionally trigger allergic reactions in sensitive individuals. Using molds like Aspergillus flavus poses a severe safety hazard due to potential aflatoxin synthesis, making rigorous mycotoxin screening mandatory. High RNA content does not prevent human protein synthesis, but it causes excessive uric acid accumulation in the body.

80. (B) The gut microbiome composition is entirely static and unaffected by dietary changes.
The gut microbiome is a dynamic ecosystem that is highly responsive to external factors, especially diet. Changes in dietary fiber, fat, and protein intake can rapidly alter the microbial composition. Dysbiosis is linked to metabolic disorders, short-chain fatty acids affect the blood-brain barrier, and metagenomic sequencing has enabled the study of unculturable species.

81. (B) P-II, Q-I, R-IV, S-III
FSSAI regulations mandate that probiotic foods maintain a minimum viable count of ten to the power of eight colony forming units. Taxonomic identification must be declared at the strain level. A warning statement is mandatory if the product is not recommended for children, and health claims require prior regulatory approval.

82. (A) High levels of secretory IgA
Probiotic bacteria face multiple physiological barriers during gastric transit, including the highly acidic gastric juice, the proteolytic enzyme pepsin, and the physical mechanical churning of the stomach wall. Secretory immunoglobulin A, however, is an antibody primarily active in mucosal secretions of the intestines and does not act as a barrier to gastric transit.

83. (C) Making a cure claim and failing to declare the probiotic at strain level
Under FSSAI regulations, food products are strictly prohibited from making medical claims that they can cure diseases. Furthermore, probiotic foods must declare the specific strain designation on the label, not just the genus name. Failing to do so and claiming to cure inflammatory bowel disease represent severe regulatory compliance failures.

84. (C) Statement I is correct and Statement II is incorrect.
The ICMR-DBT guidelines require that candidate probiotic strains undergo rigorous in vitro testing for gastric acid and bile salt tolerance to ensure their survival during digestion. However, stating that human trials are strictly forbidden is incorrect, as clinical efficacy trials on human subjects are mandatory to validate probiotic health claims.

85. (C) Kefir grains – Symbiotic bacteria and yeast in a polysaccharide matrix
Kefir is produced using kefir grains, which are complex, symbiotic starter cultures consisting of lactic acid bacteria, acetic acid bacteria, and yeasts embedded within a unique soluble polysaccharide matrix called kefiran. Sourdough starters contain lactic acid bacteria and yeasts, while tempeh is a solid-state fungal fermentation of whole soybeans.

86. (B) Incorporating microencapsulated probiotics into the matrix during curd formation
Cheese ripening presents a stressful environment for probiotic bacteria due to low water activity, high salt, and long storage times. To ensure high viability, the most effective strategy is incorporating microencapsulated probiotics into the cheese milk during curd formation. The

Downloaded from www.pdf.tube

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

encapsulation material protects the cells from osmotic stress throughout the ripening process.

87. (D) Whey – Spirulina platensis
Starch is successfully fermented by Endomycopsis fibuligera, and cellulose is degraded by Trichoderma viride. Yarrowia lipolytica is used to assimilate hydrocarbons like n-alkanes. However, Spirulina platensis is a photosynthetic cyanobacterium that requires carbon dioxide and light, making it unsuitable for direct cultivation on whey, where Kluyveromyces is typically used.

88. (A) Production of active beta-galactosidase which digests lactose in the gut
Active cultures in yogurt, such as Lactobacillus bulgaricus and Streptococcus thermophilus, synthesize the intracellular enzyme beta-galactosidase. When consumed, these cell membranes are permeabilized by bile salts in the duodenum, releasing the active enzyme. This enzyme hydrolyzes dietary lactose into glucose and galactose, effectively compensating for the host's lactase deficiency.

89. (C) They selectively alter the composition and activity of the gut microflora.
Prebiotics are non-digestible carbohydrates that resist gastric acidity and enzymatic hydrolysis in the human upper digestive tract. They pass into the large intestine, where they serve as selective substrates. By being fermented by specific beneficial bacteria like Bifidobacteria, they selectively alter the composition and metabolic activity of the gut microbiota.

90. (A) Bifidobacterium possess specific enzymes (like beta-fructofuranosidases) to ferment FOS.
Bifidobacterium species are frequently paired with fructooligosaccharides because they possess specific intracellular and extracellular enzymes, such as beta-fructofuranosidases. These specialized enzymes allow Bifidobacteria to hydrolyze and ferment FOS more efficiently than most competing gut pathogens, providing a clear competitive growth advantage within the highly crowded colon ecosystem.

91. (D) Lactobacillus
The genus Lactobacillus belongs to the lactic acid bacteria group and is morphologically characterized as rod-shaped. Depending on the specific species and metabolic pathways utilized, lactobacilli can be either homofermentative, producing only lactic acid, or heterofermentative, yielding lactic acid along with carbon dioxide, acetic acid, and ethanol.

92. (C) (A) is true but (R) is false.
Yeasts are essential in breadmaking because they drive the leavening process. However, they do not cause the dough to rise by producing lactic acid. Instead, Saccharomyces cerevisiae performs alcoholic fermentation, converting sugars into ethanol and carbon dioxide gas. It is the carbon dioxide gas that gets trapped, causing the dough to expand.

93. (C) The physical blocking of mucosal pathogen adhesion sites by probiotic cells
Competitive exclusion is a vital mechanism by which probiotic bacteria protect the host from gastrointestinal infections. It refers to the physical occupation and blocking of mucosal adhesion sites on the intestinal epithelial cells by probiotic strains. This prevents pathogenic bacteria from attaching, colonizing, and subsequently invading or damaging the host tissues.

94. (D) I, II and III only
Penicillium camemberti is a beneficial mold that forms a dense, white mycelial felt on the surface of cheeses like Camembert. It secretes highly active proteases and lipases that soften the curd and develop characteristic flavors. Crucially, this food-grade mold does not produce harmful mycotoxins like ochratoxin A.

95. (A) It produces equal amounts of lactic acid, ethanol, and CO_2.
Bifidobacteria are strictly anaerobic, Gram-positive, rod-shaped bacteria abundant in the infant gut. They ferment hexose sugars via a unique metabolic pathway known as the bifid shunt, which utilizes the enzyme fructose-6-phosphate phosphoketolase. This pathway yields lactic acid and acetic acid in a three-to-two molar ratio, without producing carbon dioxide.

NODIA

96. (B) P-III, Q-II, R-IV, S-I
Saccharomyces cerevisiae is a unicellular eukaryote that reproduces vegetatively by budding. Lactobacillus acidophilus consists of non-motile, Gram-positive rods. Aspergillus niger is a filamentous fungus characterized by distinctive conidial heads. Streptococcus thermophilus forms spherical cells arranged in chains and is classified as a Gram-positive coccus.

97. (B) It inherently lacks any nucleic acids, requiring no processing.
Single Cell Protein is highly nutritious, can be produced continuously year-round without agricultural land, and promotes sustainability by utilizing waste. However, claiming that it inherently lacks nucleic acids is incorrect. Microbial cells contain high levels of RNA, which must be reduced during downstream processing to prevent uric acid accumulation in humans.

98. (A) Post-acidification dropping pH below the strain's tolerance
During the refrigerated storage of probiotic beverages, lactic acid bacteria can continue to ferment residual sugars, a phenomenon known as post-acidification. This process continuously lowers the pH of the beverage. If the pH drops below the specific survival tolerance of Lactobacillus casei, it leads to rapid cell death and failure.

99. (A) Both Statement I and Statement II are correct.
Thermophilic starter cultures, such as Streptococcus thermophilus, have an optimum growth temperature of forty to forty-five degrees Celsius and are used for yogurt and hard cheeses. In contrast, mesophilic starter cultures, like Lactococcus lactis, thrive between twenty and thirty degrees Celsius, making them ideal for sour cream and soft cheeses.

100. (D) Zymase enzyme complex – Catalyzes fermentation of sugars to ethanol and CO_2
Aerobic respiration yields water, carbon dioxide, and high ATP, whereas anaerobic fermentation produces ethanol but low ATP. Invertase hydrolyzes sucrose into glucose and fructose. The zymase complex is a group of metabolic enzymes in yeast that catalyzes the anaerobic fermentation of simple hexose sugars into ethanol and carbon dioxide gas.

101. (C) Sweet, unfermented milk with potential contaminant off-flavors and low acidity
If bacteriophages destroy the primary acid-producing Lactococcus strain, milk acidification will fail, leaving the pH high. Although the flavor-producing Leuconostoc survives, it cannot produce sufficient acid alone. The resulting product will remain sweet and unfermented, leaving the milk highly vulnerable to rapid colonization by pathogenic or spoilage contaminant bacteria.

102. (B) Effect on gut pH – Raises pH to highly alkaline levels
Prebiotics are fermented primarily in the proximal colon by beneficial Bifidobacteria and Lactobacilli. This metabolic activity produces short-chain fatty acids, which significantly lower the luminal pH, making the environment acidic rather than alkaline. This acidic environment is highly beneficial as it inhibits the growth of pH-sensitive pathogenic bacteria.

103. (D) Microencapsulation with co-delivery of a prebiotic
Incorporating Bifidobacterium longum into an extruded biopolymer matrix with inulin utilizes the concept of microencapsulation with co-delivery of a prebiotic. The biopolymer physically protects the vegetative probiotic cells from environmental stresses, while the co-entrapped prebiotic serves as an immediate, dedicated energy source to support their survival and colonization in the colon.

104. (A) The strain must be safe for humans with documented strain-specific benefits.
FSSAI standards require that any probiotic strain used in food products must be safe for human consumption and possess documented, strain-specific health benefits. Probiotic foods must maintain high counts of viable cells, cannot contain pathogens, and must be scientifically validated rather than relying on heat-killed cells or high prebiotic proportions.

105. (C) Helps reduce the duration of acute infectious diarrhea
Extensive clinical research on Lacticaseibacillus rhamnosus GG supports its ability to help reduce the duration and severity of acute infectious diarrhea, particularly rotavirus infections in children. Probiotics do not guarantee complete prevention of all viral infections, nor can they permanently cure genetic lactose intolerance or replace childhood vaccination programs.

106. (A) Spirulina
Spirulina is a photosynthetic, multicellular cyanobacterium widely cultivated in open raceway ponds. It thrives in highly alkaline water systems with high pH levels, ranging from nine to eleven. This extreme alkaline environment is highly advantageous because it naturally inhibits the growth of most competing microalgae and pathogens, ensuring a pure culture.

Click Here to Buy book on Amazon

107. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Propionibacterium freudenreichii is essential for manufacturing Swiss-type cheeses. During the warm room ripening stage, this bacterium ferments the lactic acid produced by the primary starter culture. This fermentation yields propionic acid, acetic acid, and carbon dioxide gas. The trapped carbon dioxide gas accumulates, forming the characteristic holes or 'eyes' in the cheese.

108. (B) A buttery flavor compound produced by certain lactic acid bacteria
Diacetyl is a natural, volatile organic compound characterized by a distinct buttery flavor and aroma. It is synthesized during the metabolism of citrate by certain lactic acid bacteria, such as Leuconostoc mesenteroides and Lactococcus lactis biovar diacetylactis, playing a crucial role in the sensory profile of butter, sour cream, and buttermilk.

109. (C) I and III only
Molds in the genus Penicillium are multicellular, filamentous, and strictly aerobic organisms. Penicillium roqueforti is responsible for the ripening of Roquefort cheese. Many species within this genus are known for producing powerful secondary metabolites, including antibiotics like penicillin, and they produce blue, green, or white conidiospores, never black.

110. (D) Molds are extensively used to produce lactic acid as a primary fermentation product in dairy.
Molds are obligate aerobes utilized in cheese surface ripening and Koji production, where they secrete active proteases and amylases. Rhizopus oligosporus is essential for tempeh fermentation. However, molds are not used to produce lactic acid as a primary fermentation product in dairy, as this process is carried out by lactic acid bacteria.

111. (A) P-I, Q-II, R-III
Butyrate is the primary energy source for colonocytes and has anti-inflammatory properties. Propionate travels to the liver via the portal vein, participating in gluconeogenesis and helping lower cholesterol. Acetate is the most abundant short-chain fatty acid in systemic blood, easily crossing the blood-brain barrier to participate in peripheral metabolic processes.

NODIA

112. (B) Ability to synthesize systemic toxins
Ideal probiotic microorganisms must possess specific desirable characteristics, including the ability to adhere to the host intestinal epithelium, high tolerance to gastric acid and bile salts, and the capacity to modulate immune responses. Crucially, they must be completely safe, non-pathogenic, and must not possess the ability to synthesize systemic toxins.

113. (B) Spores resist heat, mechanical stress, and low moisture during processing.
Spore-forming bacteria like Bacillus coagulans are highly suitable for challenging food matrices such as chocolate. The bacterial endospores are extremely resistant to high temperatures, mechanical shear, and low water activity during chocolate manufacturing. This resistance ensures that the probiotic remains viable throughout processing and shelf life, germinating only after reaching the intestine.

114. (C) Statement I is correct and Statement II is incorrect.
Probiotic foods in India are regulated under the comprehensive Food Safety and Standards Regulations of 2016, which covers health supplements, nutraceuticals, and functional foods. However, stating that FSSAI mandates selling all probiotic foods as pharmaceutical drugs is incorrect, as these products are legally classified and sold as functional food items.

115. (C) Obligate homofermenters – Possess aldolase but lack phosphoketolase
Lactic acid bacteria are classified by their fermentation pathways. Obligate homofermenters ferment glucose via the Embden-Meyerhof-Parnas pathway because they possess the enzyme fructose-1,6-bisphosphate aldolase but lack phosphoketolase. This pathway yields lactic acid as the sole end-product. In contrast, heterofermenters lack aldolase and utilize the phosphoketolase pathway to yield multiple end-products.

116. (D) Excessive acidification and proteolysis by L. bulgaricus at high temperature
Bitterness and syneresis in commercial yogurt are typically caused by over-acidification and excessive proteolysis. When incubation temperatures remain too high, Lactobacillus bulgaricus grows rapidly and dominates the culture. This leads to excessive lactic acid production and the accumulation of

bitter-tasting hydrophobic peptides from milk protein breakdown, causing curd contraction and whey separation.

117. (C) Mycoprotein (e.g., Quorn) – High in saturated fat and zero fiber
Microalgae like Spirulina are rich in proteins and beta-carotene, while yeasts provide abundant B-complex vitamins, and bacterial Single Cell Protein possesses the highest protein content. However, describing mycoprotein as high in saturated fat and zero fiber is incorrect, as it is naturally high in dietary fiber and very low in saturated fat.

118. (B) It acts as a prebiotic substrate, boosting probiotic survival and colonization.
Incorporating beta-glucan into a probiotic oat milk formulation provides significant functional benefits. Beta-glucan is a soluble dietary fiber that acts as an effective prebiotic substrate. It escapes digestion and is selectively fermented by the Lactobacillus strain, boosting its survival, metabolic activity, and ability to colonize the host gastrointestinal tract.

119. (D) The prebiotic is designed to selectively stimulate the co-administered probiotic strain.
Synbiotics represent functional mixtures of probiotics and prebiotics. In a synergistic synbiotic, the prebiotic component is specifically selected for its ability to be preferentially fermented by the co-administered probiotic strain. This selective stimulation enhances the survival, persistence, and metabolic activity of the beneficial bacteria as they transit through the gastrointestinal tract.

120. (A) They are anaerobes that grow slowly in milk without growth promoters.
Bifidobacteria are strictly anaerobic bacteria that grow very slowly in milk because they lack extensive proteolytic systems and are highly sensitive to dissolved oxygen. Consequently, they are rarely used alone as traditional starter cultures for dairy fermentation and are instead paired with fast-growing, oxygen-consuming lactic acid bacteria to support their growth.

121. (C) The entire habitat: the microbes, their genomes, and the environmental conditions
The term microbiome is defined as the entire habitat, including all living microorganisms—such as bacteria, archaea, fungi, and viruses—their collective genomes, and the surrounding environmental conditions. This concept encompasses both the biotic microbial community and the abiotic chemical and physical factors characteristic of a specific ecological niche.

122. (B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
Inulin is highly soluble in hot water and forms a physical gel network upon cooling, which mimics the mouthfeel of fat. This allows it to serve as an effective fat replacer in low-fat foods. While it also acts as a prebiotic, its fat-mimicking ability is a physical property, not a consequence of its fermentation.

123. (D) A concentrated culture designed to be added directly to the production vat
Direct Vat Set starter cultures are highly concentrated, standardized microbial preparations. They are designed to be inoculated directly into the main production vat without requiring any intermediate activation, propagation, or scaling-up steps at the dairy plant. This technology significantly reduces the risk of contamination and ensures highly consistent fermentation performance.

124. (B) I, II and IV only
Freeze-drying is a common method for preserving probiotics, though it induces osmotic and cold stress. Cryoprotectants like skim milk protect cell viability during freezing. Alginate encapsulation effectively shields probiotics from low gastric pH. However, spray drying is successfully used commercially for certain robust strains, making the claim of inevitable death incorrect.

125. (C) Probiotics must colonize the gut permanently to exert any health benefits.
The gut microbiome plays a vital role in host metabolism, and regular probiotic intake can alleviate pediatric dermatitis. Prebiotics naturally occur in foods like bananas and garlic. However, probiotics do not need to colonize the gut permanently to exert health benefits; they can provide transient benefits as they pass through.

126. (D) P-II, Q-III, R-IV, S-I
Soy sauce fermentation utilizes Aspergillus oryzae. Sourdough bread relies on Candida milleri and Lactobacillus sanfranciscensis. Kefir is produced by a symbiotic matrix of bacteria and yeasts. Swiss cheese requires Propionibacterium freudenreichii to produce its characteristic eyes.

Downloaded from www.pdf.tube

This demonstrates the specific microbial groups essential for producing diverse fermented foods.

127. (A) Refined sucrose
Industrial production of Single Cell Protein utilizes cheap, low-value byproducts to remain economically viable. Common substrates include sugarcane molasses, acid or sweet whey, and sulfite waste liquor from paper mills. In contrast, refined sucrose is a high-cost, purified food ingredient and is not used as a substrate for commercial biomass production.

128. (B) 1×10^{10} CFU/g
To achieve a final viable count of ten to the power of seven colony forming units per gram after three months, with a decay rate of one log reduction per month, the total loss over the shelf life is three logs. Therefore, the minimum initial inoculum at manufacturing must be ten to the power of ten.

129. (A) Both Statement I and Statement II are correct.
Quorn is produced continuously in pressurized airlift bioreactors using the filamentous fungus Fusarium venenatum. Following fermentation, the harvested biomass must undergo a rapid heat treatment step. This thermal processing activates endogenous ribonucleases, which degrade cellular RNA to levels below two percent, rendering the final mycoprotein safe for human dietary consumption.

130. (A) High-fiber diet – Increases SCFA-producing bacteria
Consuming a high-fiber diet increases the abundance of short-chain fatty acid-producing bacteria in the gut. Antibiotic usage typically reduces microbial diversity, while exclusive formula feeding does not enrich solely for Bifidobacteria. Additionally, the ratio of beneficial Bifidobacteria naturally declines with aging, rather than increasing, making dietary fiber intake essential.

131. (C) Fecal Microbiota Transplantation (FMT)
Fecal Microbiota Transplantation is increasingly recognized as a highly effective clinical therapy for patients suffering from recurrent Clostridioides difficile infections. This procedure involves introducing a prepared filtrate of healthy donor stool into the patient's gut, which rapidly restores a diverse, balanced microbiome that competitively excludes the pathogenic bacteria.

NODIA

132. (D) Storage conditions – Optional; probiotics survive at any temperature
FSSAI guidelines mandate that commercial probiotic products clearly display the term "Probiotic Food", along with the best before date and validated health claims. However, specifying storage conditions is not optional. Probiotics are highly sensitive to thermal stress, and indicating proper refrigeration or storage temperatures is mandatory to preserve cell viability.

133. (C) It represents Colony Forming Units, indicating viable, culturable cells.
CFU stands for Colony Forming Units, which is a key metric in evaluating probiotic product quality. This measurement estimates the number of viable, culturable microbial cells in a sample capable of multiplying and forming visible colonies under specific laboratory growth conditions, rather than counting dead cells or total physical biomass.

134. (B) Homofermentative LAB yield only lactic acid, while heterofermentative yield lactic acid, ethanol, and CO_2.
Homofermentative lactic acid bacteria ferment hexose sugars primarily via the Embden-Meyerhof-Parnas pathway, yielding lactic acid as the sole end-product. In contrast, heterofermentative strains utilize the phosphoketolase pathway, producing lactic acid along with significant amounts of ethanol, carbon dioxide gas, and acetic acid, which contributes to gas production and flavor development.

135. (D) Cross-feeding (Syntrophy)
Cross-feeding, also known as syntrophy, is a metabolic interaction where the waste products or metabolic end-products of one microorganism serve as essential nutrients or substrates for another species. This cooperative process is highly common in the gut microbiota, where certain bacteria ferment prebiotics into lactate, which is then utilized by butyrate-producing strains.

136. (A) Production of lactase enzyme for lactose-free milk
The yeast Kluyveromyces lactis is primarily utilized in the food industry for the commercial production of the enzyme lactase, also known as beta-galactosidase. This enzyme is widely used to hydrolyze lactose in milk into glucose and galactose, enabling the manufacture of lactose-free dairy products suitable for lactose-intolerant consumers.

CHAPTER 13

Temperature-Based Microbial Groups in Processed Food

1. Which of the following defines the typical optimal growth temperature range for true psychrophiles?
(A) 20°C to 30°C
(B) 15°C or lower
(C) 30°C to 40°C
(D) 45°C to 55°C

2. Consider the following statements regarding psychrotrophic microorganisms:
1. They have an optimal growth temperature above 20°C but can multiply at refrigeration temperatures.
2. Pseudomonas species are prominent psychrotrophic spoilers in protein-rich foods.
3. They are unable to survive in environments above 10°C.
4. Listeria is an example of a psychrotrophic organism that poses a significant food safety risk.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 2, 3, and 4
(C) 1, 3, and 4
(D) 1, 2, and 3

3. Which of the following statements correctly differentiates psychrotrophs from psychrophiles?
(A) Psychrotrophs grow at 0–7°C with mesophilic optima, while psychrophiles grow optimally at 15°C or lower.
(B) Psychrotrophs grow optimally at 4°C, while psychrophiles grow optimally at ambient room temperatures of 25°C.
(C) Psychrophiles exhibit high resistance to thermal processing, while psychrotrophs are easily heat-inactivated.
(D) Psychrotrophs require high osmotic pressure for survival, while psychrophiles require highly acidic matrices.

4. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Refrigeration alone is insufficient to prevent the growth of all foodborne pathogens over an extended period.
Reason (R): Psychrotrophic microorganisms like Listeria can actively multiply at standard refrigeration temperatures.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

5. A dairy processing plant notices that pasteurized milk stored strictly at 4°C is developing a bitter off-flavor and slight coagulation well before its intended shelf life. Which group of microorganisms is most likely responsible for this spoilage?
(A) Psychrotrophic spoilers like Pseudomonas
(B) True psychrophiles like Polaromonas
(C) Thermophilic spore-formers like Bacillus
(D) Extreme halophiles like Halobacterium

6. Match the items in List I with the items in List II:
List I: (Microbial Group)
P. Psychrophile
Q. Mesophile
R. Thermophile
S. Hyperthermophile
List II: (Characteristic)
I. Optimal growth above 80°C
II. Optimal growth around 37°C
III. Optimal growth typically between 55°C and 65°C
IV. Optimal growth at 15°C or lower
(A) P-IV, Q-II, R-III, S-I
(B) P-II, Q-IV, R-I, S-III
(C) P-IV, Q-III, R-II, S-I

Click Here to Buy book on Amazon

releasing significant amounts of carbon dioxide gas that bloat the packaging.

147. (C) Streptococcus pyogenes – Routine probiotic used for immune boosting
Saccharomyces boulardii treats antibiotic-associated diarrhea, Lacticaseibacillus rhamnosus GG reduces rotavirus diarrhea, and Bifidobacterium infantis alleviates irritable bowel syndrome. However, pairing Streptococcus pyogenes with routine probiotic use is incorrect, as Streptococcus pyogenes is a well-known human pathogen responsible for strep throat, scarlet fever, and other serious clinical infections.

148. (D) To induce heat-shock proteins (HSPs) providing tolerance to subsequent thermal stress
Applying a sublethal heat shock to probiotic cultures prior to spray drying is a critical technological strategy. This mild thermal stress induces the cellular synthesis of heat-shock proteins, which act as molecular chaperones. These proteins stabilize cellular structures, protecting the cell membranes and enzymes from damage during subsequent high-temperature spray drying.

149. (C) FSSAI maintains an approved list of prebiotics (like Inulin, FOS) with defined limits.
FSSAI regulates the use of prebiotics in India by maintaining an officially approved list of prebiotic substances, such as inulin and fructooligosaccharides, along with specified maximum limits and purity standards. Prebiotics are not banned in infant formulas, nor can any fiber be labeled as a prebiotic without proper scientific validation.

150. (B) Dysbiosis
In microbiome research, dysbiosis refers to an imbalance, maladaptation, or disruption in the normal, healthy composition of the microbiota. This condition is characterized by a loss of beneficial microbial species, an overgrowth of potentially pathogenic organisms, or a reduction in overall microbial diversity, which is often associated with various inflammatory diseases.

www.nodia.in

Downloaded from www.pdf.tube

137. (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
The viability of probiotics in fermented dairy products often declines rapidly during storage. This occurs because the lactic acid bacteria continue to produce organic acids during refrigeration, a process known as post-acidification. This continuous acid accumulation lowers the pH of the product to levels that are highly stressful and lethal to sensitive probiotic strains.

138. (A) Ribosomally synthesized bacterial peptides that inhibit related species
Bacteriocins are ribosomally synthesized peptides or proteins produced by bacteria, including many lactic acid bacteria strains. These compounds exhibit antimicrobial activity, typically targeting and inhibiting the growth of closely related bacterial species. They serve as natural food preservation agents, helping to control the proliferation of undesirable pathogens and spoilage organisms.

139. (D) I, II and III only
Preparing commercial yogurt cultures involves selecting non-phage-sensitive strains and growing them in separate vessels to control growth rates. The strains are then blended to achieve the desired rod-to-coccus ratio. However, autoclaving the final blend is unacceptable as it would completely kill the live starter culture cells, preventing any subsequent fermentation.

140. (B) All Aspergillus species are universally recognized as GRAS and completely safe for food use.
Molds are more tolerant of low water activity than bacteria, and species like Penicillium nalgiovense are used in fermented meats. However, claiming all Aspergillus species are GRAS is incorrect. While Aspergillus oryzae is safe, other species like Aspergillus flavus produce highly carcinogenic aflatoxins and are major food safety hazards.

141. (C) P-IV, Q-I, R-II, S-III
Homofermentative lactic acid bacteria produce primarily lactic acid. Saccharomyces cerevisiae ferments sugars in dough to yield ethanol and carbon dioxide gas. Propionibacterium species ferment lactate in cheese to produce propionic acid, acetic acid, and carbon dioxide. Acetobacter species oxidize ethanol in wine to produce acetic acid during vinegar production.

142. (D) Direct binding of toxic heavy metals in the stomach
Prebiotics exert their beneficial health effects by selectively stimulating the growth of beneficial gut bacteria, increasing fecal biomass to improve bowel movements, and producing beneficial short-chain fatty acids through microbial fermentation. They do not function by directly binding toxic heavy metals in the stomach, which is not an established prebiotic mechanism.

143. (A) The claim must have robust human clinical trials and FSSAI panel approval.
Under FSSAI guidelines for functional foods and probiotics, making specific functional health claims requires rigorous scientific validation. The manufacturer must submit robust, strain-specific evidence from human clinical trials demonstrating the claimed physiological benefit. This data must be reviewed and officially approved by the FSSAI scientific panel prior to commercialization.

NODIA

144. (C) Statement I is correct and Statement II is incorrect.
The nutritional quality of Single Cell Protein is evaluated using indices like Biological Value and Protein Efficiency Ratio. However, stating that SCP lacks essential vitamins is incorrect, as microbial biomass is naturally a rich source of B-complex vitamins and various minerals, requiring little to no artificial fortification for general nutritional applications.

145. (B) Lyophilized cultures – Water is removed via sublimation under vacuum to induce dormancy
Lyophilized cultures are prepared by freezing the microbial cell suspension and removing water through sublimation under a vacuum. This process preserves the cells in a dormant state, ensuring long-term stability and viability at room temperature. Liquid starters are highly perishable, and deep-frozen cultures require cryoprotectants to survive freezing.

146. (A) Contamination with heterofermentative LAB, coliforms, or yeasts
Bulging and effervescence in a probiotic dairy drink containing only homofermentative bacteria indicates contamination. The gas production is typically caused by contaminant heterofermentative lactic acid bacteria, coliforms, or wild yeasts. These contaminating organisms ferment the residual sugars in the product,

(D) P-I, Q-II, R-III, S-IV

7. Which of the following organisms is NOT typically classified as a mesophile?
(A) Salmonella enterica Serovar Typhimurium
(B) Clostridium thermosaccharolyticum
(C) Escherichia coli Strain O157:H7
(D) Staphylococcus aureus Subspecies aureus

8. Consider the following statements:
Statement I: The "Danger Zone" in food safety is universally recognized as the temperature range between 5°C and 60°C.
Statement II: Within the Danger Zone, most human foodborne pathogens multiply rapidly.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

9. Arrange the following microbial classifications in the correct sequence from the lowest optimal growth temperature to the highest.
1. Thermophile
2. Mesophile
3. Psychrophile
4. Hyperthermophile

(A) 3, 2, 1, 4
(B) 2, 3, 1, 4
(C) 3, 1, 2, 4
(D) 4, 1, 2, 3

10. Which of the following pairs is correctly matched regarding food spoilage?
(A) Clostridium thermosaccharolyticum - Gaseous spoilage in high-temperature stored foods
(B) Pseudomonas - Thermophilic spoilage of low-acid commercially sterile canned foods
(C) Listeria - Flat sour spoilage of vacuum-packaged thermal-processed canned goods
(D) Staphylococcus - Deep-sea seafood spoilage under high-pressure hyperbaric conditions

11. Which of the following statements regarding mesophilic microorganisms is incorrect?
(A) Their optimum growth temperature typically falls between 20°C and 45°C.
(B) They are the primary agents of flat sour spoilage in commercially sterile canned foods.
(C) Almost all human bacterial pathogens are classified under this temperature-based group.
(D) Temperature abuse leaving food at room temperature primarily encourages their rapid growth.

12. A food handler leaves a large batch of cooked rice on the counter to cool slowly overnight at room temperature (approximately 25°C). Which microbial group poses the greatest rapid proliferation risk in this scenario?
(A) Barophilic organisms
(B) Mesophilic pathogens
(C) Hyperthermophilic flora
(D) Psychrophilic species

13. What defines a thermophilic microorganism in the context of food microbiology?
(A) An organism with an optimum growth temperature generally between 50°C and 70°C.
(B) An organism that survives frozen temperatures and grows rapidly during subsequent thawing.
(C) An organism that maintains its highest rate of cellular replication at human body temperature.
(D) An organism requiring high concentrations of sodium chloride and heat energy simultaneously.

14. A failure to rapidly chill freshly pasteurized milk prior to transport leads to elevated bacterial counts. What is the primary cause-and-effect relationship operating here?
(A) The lack of cooling immediately induces thermophilic spore germination and subsequent toxin release in milk.
(B) Elevated temperatures cause highly resistant barophiles to dominate the liquid milk protein matrix.
(C) Temperature abuse allows surviving mesophilic and psychrotrophic microbes to exit the lag phase and multiply.
(D) Temperature abuse triggers metabolic pathways that convert non-pathogenic psychrophiles into mesophilic cells.

15. Which of the following pairs is incorrectly matched?

Click Here to Buy book on Amazon

2. They grow optimally between 20°C and 45°C.
3. Escherichia coli and Salmonella enterica are classic examples.
4. They are completely eradicated by simply lowering the temperature to 4°C.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 3
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 4

78. Which of the following statements correctly highlights the food safety relevance of mesophiles?
(A) They represent the primary group of environmental organisms responsible for rapid and severe spoilage of products kept under long-term deep-freezer storage conditions.
(B) They are highly prized and widely utilized in the global food processing industry for producing specialized enzymes that remain extremely active above 80°C.
(C) Because the vast majority of foodborne pathogens are mesophiles, strict temperature control (hot holding or cold holding) is essential to prevent their rapid multiplication.
(D) They thrive exclusively in highly extreme, specific food microenvironments that are completely devoid of gaseous oxygen and exceptionally high in sodium chloride.

79. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Keeping perishable foods at room temperature for several hours significantly increases the risk of foodborne illness.
Reason (R): Room temperature falls squarely within the optimal growth range for mesophilic foodborne pathogens, allowing exponential multiplication.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

80. At a summer picnic, a potato salad is left outside in 30°C heat for 5 hours. Subsequently, several individuals develop severe gastrointestinal distress. The outbreak is most likely due to the rapid growth of which temperature-based microbial group?
(A) Psychrotrophs
(B) Thermophiles
(C) Mesophiles
(D) Osmophiles

81. Match the items in List I with the items in List II:
List I: (Pathogen)
P. Campylobacter jejuni
Q. Listeria monocytogenes
R. Clostridium botulinum (proteolytic)
S. Yersinia enterocolitica
List II: (Behavioral Characteristic)
I. Mesophile with optimal growth near body temperature (approx. 42°C).
II. Psychrotrophic, capable of multiplying in refrigerated RTE foods.
III. Psychrotrophic pathogen often associated with pork products.
IV. Mesophilic spore-former producing toxin at ambient temperatures.
(A) P-I, Q-II, R-IV, S-III
(B) P-IV, Q-II, R-I, S-III
(C) P-I, Q-III, R-IV, S-II
(D) P-II, Q-I, R-III, S-IV

82. Which of the following organisms is NOT classified as a mesophilic pathogen?
(A) Shigella dysenteriae pathogen
(B) Vibrio cholerae serogroup O1
(C) Escherichia coli strain O157:H7
(D) Geobacillus stearothermophilus

83. Consider the following statements:
Statement I: The lag phase of a mesophilic pathogen will be significantly longer at 10°C compared to 35°C.
Statement II: At temperatures below their minimum growth limit, mesophilic cells generally die off instantaneously.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

84. As a Food Safety Officer auditing a buffet restaurant, you observe cooked curries being

NODIA

Statement II: Hyperthermophiles have optimal growth temperatures exceeding 80°C.

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

24. Arrange the following spore-forming organisms in typical order of their heat resistance (D-value) from lowest to highest.

1. Mesophilic non-spore forming bacteria
2. Mesophilic spore-formers (e.g., Clostridium botulinum)
3. Thermophilic spore-formers (e.g., Geobacillus stearothermophilus)

(A) 1, 2, 3
(B) 1, 3, 2
(C) 2, 1, 3
(D) 3, 2, 1

25. Which of the following pairs of pathogen and its tolerance mechanism is correctly matched?

(A) Vibrio parahaemolyticus - Xerotolerance
(B) Listeria monocytogenes - Thermotolerance
(C) Salmonella species - Psychrophilic growth
(D) Staphylococcus aureus - Halotolerance

26. Which of the following statements about xerophiles and osmophiles is incorrect?

(A) Osmophiles are primarily found in high-protein, low-sugar environments like fresh fish.
(B) Xerophiles are adapted to survive and grow efficiently in low water activity environments.
(C) High sugar foods like jams and honey are highly susceptible to osmotic spoilage by yeasts.
(D) Dried foods like grains and cereals are commonly targeted by various xerophilic molds.

27. A food manufacturer formulates a new fruit preserve with 65% sugar content. Despite the high osmotic pressure, the product eventually shows signs of fermentation and gas production. Which functional group of microbes is best adapted to cause this issue?

(A) Halophiles
(B) Osmophiles
(C) Barophiles
(D) Psychrophiles

28. Which definition best describes a halophile?

(A) A microorganism that thrives exclusively under extreme hydrostatic pressure in deep sea.
(B) A microorganism that requires high concentrations of sodium chloride for optimal growth.
(C) A microorganism that prefers highly acidic environments below pH 3 with low osmotic pressure.
(D) A microorganism that grows exclusively in dried, dehydrated matrices in the absence of free water.

29. In deep-sea seafood harvesting, barophiles are occasionally isolated from the catch. What is the fundamental cause of their specific ecological adaptation?

(A) The extreme hydrostatic pressures present in deep-sea environments.
(B) The requirement of high salt concentrations for intracellular osmotic balance.
(C) The total lack of solar radiation and sunlight penetrating ocean depths.
(D) The extremely high thermal gradients near oceanic volcanic vents.

30. Which of the following pairs linking a microbial group to an extreme food environment is incorrect?

(A) Osmophiles - Jams and jellies
(B) Acidophiles - Citrus juices
(C) Barophiles - Cured and dried hams
(D) Halotolerant organisms - Salted soy sauce

31. Deep-sea seafood products are the natural habitat for which specific group of extremophiles?

(A) Acidophiles
(B) Xerophiles
(C) Osmophiles
(D) Piezophiles

32. Consider the following statements about halotolerant pathogens:

1. They require high salt concentrations to survive and cannot grow without it.
2. Staphylococcus aureus is a notable halotolerant pathogen capable of growing in cured meats.
3. Vibrio species often exhibit halotolerance or

Downloaded from www.pdf.tube

(C) They provide a verified record of temperature conditions to ensure HACCP critical limits have not been breached.
(D) They predict the exact moment a foodborne pathogen will mutate into a more virulent strain using built-in sensors.

49. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The heat resistance of spore-forming organisms dictates the required time and temperature for thermal processing of low-acid canned foods.
Reason (R): Spores of organisms like Clostridium botulinum can survive boiling temperatures and require temperatures typically around 121°C for effective destruction.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

50. A processing facility intends to rely on a predictive microbiology model to extend the shelf life of a chilled, modified-atmosphere packaged meal. Which set of data is absolutely essential to input into the model for an accurate prediction?
(A) The physical dimensions of the packaging material and its primary color.
(B) The specific heat capacity, density, and moisture content of the food matrix.
(C) The localized atmospheric pressure and altitude at the point of retail display.
(D) The precise temperature profile of the storage and distribution chain.

51. Match the items in List I with the items in List II:
List I: (HACCP Component)
P. Critical Control Point (CCP)
Q. Critical Limit
R. Monitoring Procedure
S. Corrective Action
List II: (Practical Example)
I. Checking internal meat temperature with a calibrated thermometer every 2 hours.
II. The cooking step for raw poultry.
III. Re-cooking or discarding poultry that has not reached the target temperature.
IV. Achieving an internal temperature of at least 74°C.
(A) P-II, Q-IV, R-I, S-III
(B) P-IV, Q-II, R-III, S-I
(C) P-I, Q-III, R-II, S-IV
(D) P-II, Q-I, R-IV, S-III

NODIA

52. Which of the following is NOT a consequence of a break in cold chain integrity for processed, refrigerated foods?
(A) Accelerated growth of psychrotrophic spoilers.
(B) Outgrowth of mesophilic pathogens if temperatures rise sufficiently.
(C) Immediate destruction of heat-resistant thermophilic spores.
(D) Significant reduction in the expected shelf life of the product.

53. Consider the following statements:
Statement I: Data loggers and Time-Temperature Indicators (TTIs) are advanced temperature monitoring systems used in modern food storage.
Statement II: TTIs can physically show the cumulative time-temperature history a product has been exposed to.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

54. Arrange the general steps of implementing a temperature-based Critical Control Point (CCP) in a HACCP plan in the correct sequential order.
1. Establish critical limits (e.g., minimum cooking temp).
2. Determine corrective actions if the limit is breached.
3. Identify the heating/cooling step as a CCP.
4. Establish monitoring procedures for the temperature.
(A) 3, 1, 4, 2
(B) 1, 3, 2, 4
(C) 3, 4, 1, 2
(D) 1, 2, 3, 4

55. Which of the following pairs is correctly matched regarding thermal processing?
(A) Z-value - Temperature change required to alter the D-value of a specific microorganism

40. Which of the following pairs is correctly matched regarding extreme pH food environments?
(A) Alkalophiles - Highly acidic fruit juices
(B) Osmophiles - Pickled vegetables
(C) Acidophiles - Fermented yogurt and kefir
(D) Halophiles - Extremely alkaline egg products

41. Which of the following statements regarding the effect of temperature abuse on microbial growth is incorrect?
(A) Temperature abuse allows foods to enter the danger zone, promoting rapid pathogen multiplication and toxin production.
(B) Extended periods of severe temperature abuse reduce the physiological accuracy and effectiveness of predictive models.
(C) Intermittent warming of chilled foods can lead to the rapid outgrowth of highly resistant mesophilic bacterial spores.
(D) Fluctuating temperatures during transport exclusively affect physical sensory properties, not overall microbial safety.

42. A food logistics company uses a chilled transport vehicle. A breakdown causes the internal temperature to rise to 22°C for 6 hours. Which fundamental food safety principle has been violated?
(A) Cold chain integrity
(B) Heat resistance mapping
(C) Osmotic stabilization
(D) Hyperthermophilic inhibition

43. In food safety regulations, the "Danger Zone" is defined as:
(A) -18°C to 0°C
(B) 5°C to 60°C
(C) 0°C to 4°C
(D) 65°C to 100°C

44. What is the primary cause-and-effect relationship regarding temperature control in a HACCP plan?
(A) Monitoring temperature limits (cause) prevents the irreversible genetic transition of psychrophiles into thermophiles (effect).
(B) Enforcing critical temperature limits (cause) prevents or slows the multiplication of foodborne pathogens to dangerous levels (effect).
(C) Maintaining high heat (cause) ensures the thermal survival of essential, industrially relevant extrema-enzymes in the matrix (effect).
(D) Lowering the temperature (cause) increases the heat resistance of bacterial endspores during subsequent canning retorting (effect).

45. Which of the following pairs linking a processing concept to its definition is incorrectly matched?
(A) D-value - The temperature required to destroy 90% of a microbial population in one minute
(B) Predictive microbiology - Using mathematical models to estimate microbial growth under specific environmental conditions
(C) Cold chain - A continuous temperature-controlled supply chain
(D) Temperature abuse - Storing perishable food outside safe temperature limits

46. What is the upper temperature limit of the standard food safety Danger Zone, above which most mesophilic pathogens cease to multiply rapidly and vegetative cells begin to die?
(A) 45°C
(B) 50°C
(C) 60°C
(D) 72°C

47. Consider the following statements about predictive microbiology models for temperature-dependent growth:
1. They utilize mathematical equations to forecast microbial behavior.
2. They negate the need for practical temperature monitoring systems.
3. They are heavily influenced by temperature, pH, and water activity parameters.
4. They assist in estimating the safe shelf life of processed foods.

Which of the above statement(s) is/are correct?
(A) 1, 3, and 4
(B) 1, 2, and 3
(C) 2, 3, and 4
(D) 1, 2, and 4

48. Which of the following correctly describes the role of temperature monitoring systems in food transport?
(A) They actively cool the food during transit by adjusting refrigeration units automatically to maintain the cold chain.
(B) They sterilize the transport cargo environment using UV radiation to prevent any psychrotrophic bacterial growth.

Click Here to Buy book on Amazon

hazard rather than just a spoilage organism.
Which of the above statement(s) is/are correct?
(A) 1, 3, and 4
(B) 1, 2, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

63. Which statement correctly identifies a key adaptation of psychrotrophic microorganisms to cold environments?
(A) Formation of extremely thick, highly cross-linked peptidoglycan outer cell walls to physically insulate the cold cell.
(B) Production and metabolic utilization of specialized heat-stable enzymes that only catalyze reactions above 50°C.
(C) Accumulation of extremely high intracellular concentrations of sodium chloride salts to structurally prevent internal freezing.
(D) Increased proportions of unsaturated fatty acids in the cell membrane lipid bilayer to maintain homeoviscous fluidity.

64. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Ready-to-eat deli meats represent a major risk for listeriosis if subjected to prolonged refrigerated storage.
Reason (R): Listeria monocytogenes is a psychrotroph that can outgrow background microflora at standard refrigeration temperatures over time.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

65. A batch of refrigerated pasteurized milk develops a fruity odor and ropy texture after 10 days at 4°C. The causative organism is Gram-negative, strictly aerobic, and highly mobile. Which of the following is the most likely genus?
(A) Listeria
(B) Pseudomonas
(C) Clostridium
(D) Salmonella

66. Match the items in List I with the items in List II:
List I: (Feature)
P. Pseudomonas fluorescens
Q. Listeria monocytogenes
R. Membrane fluidity adaptation
S. Proteolytic spoilage
List II: (Description)
I. Major cause of off-flavors and slime in refrigerated raw meats.
II. Psychrotrophic pathogen of severe concern in unpasteurized cheeses.
III. Breakdown of proteins in milk causing bitter flavors at cold temperatures.
IV. Increased unsaturated fatty acids at low temperatures.
(A) P-I, Q-II, R-IV, S-III
(B) P-II, Q-I, R-III, S-IV
(C) P-IV, Q-III, R-I, S-II
(D) P-I, Q-IV, R-II, S-III

NODIA

67. Which of the following is NOT an adaptation typically seen in psychrophilic and psychrotrophic bacteria?
(A) Increased synthesis of highly saturated lipids in the cell membrane.
(B) Production of cold-shock proteins.
(C) Synthesis of enzymes with high catalytic efficiency at low temperatures.
(D) Maintenance of membrane fluidity at temperatures near 0°C.

68. Consider the following statements:
Statement I: True psychrophiles are the primary cause of spoilage in standard household refrigerators.
Statement II: Psychrotrophs outcompete true psychrophiles in many refrigerated foods because they can grow faster at 4°C to 10°C and survive brief warming.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

69. You are training staff on temperature control. If asked to classify microorganisms based on their optimal growth temperatures, how would you instruct them to order the following from coldest optimal temperature to hottest?
1. Mesophiles
2. Hyperthermophiles

by exactly one decimal factor
(B) D-value - Time required at a specific temperature to achieve a 90% or 1-log reduction of a target microbial population
(C) F-value - Total equivalent time of a thermal process at a reference temperature designed to destroy a target spore
(D) 12D concept - A sterilization target engineered to safely reduce the spores of proteolytic Clostridium botulinum

56. Which of the following about predictive microbiology is incorrect?
(A) Primary models describe changes in microbial numbers over time under constant conditions.
(B) Secondary models describe how primary model parameters change with environmental conditions like temperature.
(C) Predictive models completely replace the need for traditional end-product microbiological testing.
(D) Tertiary models integrate primary and secondary models into user-friendly software.

57. When rapidly cooling cooked foods to prevent microbial hazards, why is it critical to move the food through the 60°C to 20°C range as quickly as possible?
(A) This temperature range selectively and irreversibly triggers the rapid germination of psychrotrophic bacterial spores.
(B) Slower cooling within this specific range causes the food protein matrix to undergo rapid, irreversible souring.
(C) The food product will absorb high concentrations of environmental barophilic organisms if cooling rates decrease.
(D) This range is the optimal growth temperature for most rapid-multiplying mesophilic pathogens and spore-formers.

58. How is cold chain integrity fundamentally defined in the context of food safety?
(A) The uninterrupted handling, storage, and transport of products within a specified low-temperature range.
(B) The chemical process of freezing raw food ingredients to absolute zero to permanently halt spoilage mechanisms.
(C) The systematic integration of predictive microbiological modeling equations directly into HACCP record logs.
(D) The structural barrier in insulation packaging materials that physically prevents cold ambient air from escaping.

59. What is a direct cause-and-effect result of temperature abuse on spore-forming organisms in cooked foods held at 40°C?
(A) The heat shock causes surviving bacterial spores to enter an irreversible, permanently inactive dormant metabolic state.
(B) Surviving spores can germinate, and the resulting vegetative cells will rapidly multiply and potentially produce toxins.
(C) Vegetative cellular structures will undergo instantaneous, rapid sporulation cycles to shield themselves from warmth.
(D) The spores will immediately mutate into hyperthermophilic organisms through thermal alteration of their genetic material.

60. Which of the following pairs linking a temperature concept to its food safety application is incorrectly matched?
(A) 5°C to 60°C - The Danger Zone
(B) Time-Temperature Indicator - Destroys pathogens during transport
(C) HACCP - Systematic preventive approach to temperature and other hazards
(D) Continuous logging - Validating cold chain integrity

61. Which structural feature primarily allows Pseudomonas species to metabolize and cause spoilage in refrigerated foods?
(A) Extracellular lipases and proteases that remain active at low temperatures.
(B) The structural formation of heat-resistant bacterial endospores in the matrix.
(C) High percentages of saturated fatty acid chains inside their cell membranes.
(D) The metabolic capacity to ferment lactose rapidly under refrigeration at 4°C.

62. Consider the following statements about Listeria monocytogenes as a psychrotrophic spoiler:
1. It is a significant hazard in ready-to-eat (RTE) foods stored in refrigerators.
2. It causes food spoilage characterized by massive gas production and bloating of packaging.
3. It can multiply at temperatures as low as 0°C to 4°C.
4. It is primarily considered a food safety

NODIA

(A) Extreme pH environment - Alkalophiles
(B) Cured and salted foods - Halophiles
(C) Refrigerated meats - Psychrotrophs
(D) Sugar-rich foods - Barophiles

16. Which spoilage defect is primarily associated with the growth of thermophilic spore-forming bacteria in canned foods without bulging of the can?
(A) Sulphide stinker spoilage
(B) Putrefactive anaerobic spoilage
(C) Flat sour spoilage
(D) Psychrotrophic rancidity

17. Consider the following statements regarding flat sour spoilage in canned foods:
1. It is caused by obligate or facultative thermophilic spore-formers.
2. The can ends remain flat while the contents become highly acidic.
3. It is commonly associated with significant gas production.
4. Inadequate cooling of cans after thermal processing is a primary cause.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 1, 2, and 3
(C) 2, 3, and 4
(D) 1, 3, and 4

18. Which of the following is a correct statement regarding Clostridium thermosaccharolyticum?
(A) It is a non-spore-forming psychrotroph that causes extensive proteolytic spoilage in refrigerated fresh seafood.
(B) It is primarily responsible for flat sour spoilage without gas production in low-acid thermal processed canned foods.
(C) It only grows in highly aerobic, refrigerated environments and requires high salt concentrations for stability.
(D) It is a thermophilic obligate anaerobe known to cause gaseous spoilage and hard swells in canned foods.

19. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sulphide stinker spoilage in canned foods is characterized by a blackened product and a strong odor of hydrogen sulphide.
Reason (R): The responsible thermophilic spores survive thermal processing and reduce sulphates to hydrogen sulphide during growth.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

20. A batch of low-acid canned peas was stored near a boiler in a processing plant where temperatures often reach 48°C. Upon opening, the peas taste highly acidic, but the cans show no signs of swelling. This spoilage is most likely an example of:
(A) Putrefaction by mesophiles
(B) Hydrogen swell by acidophiles
(C) Flat sour spoilage by thermophiles
(D) Sulphide stinker spoilage

21. Match the items in List I with the items in List II:
List I: (Extremophile Group)
P. Halophiles
Q. Xerophiles
R. Osmophiles
S. Acidophiles
List II: (Food Environment)
I. Fermented fruit juices (low pH)
II. High-sugar syrups and honeys
III. Dried foods with low moisture
IV. Salted fish and cured meats
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-II, R-III, S-I
(D) P-II, Q-III, R-IV, S-I

22. Which of the following is NOT an application or characteristic of hyperthermophiles in food biotechnology?
(A) Sourcing heat-stable enzymes like amylases and proteases.
(B) Utilizing enzymes that function efficiently in continuous high-temperature processing.
(C) Catalyzing reactions that require elevated temperatures to prevent mesophilic contamination.
(D) Fermenting refrigerated dairy products to produce yogurt.

23. Consider the following statements:
Statement I: Enzymes isolated from hyperthermophiles are generally denatured at standard pasteurization temperatures.

Downloaded from www.pdf.tube

3. Psychrophiles
4. Thermophiles
5. Psychrotrophs

(A) 3, 5, 1, 4, 2
(B) 5, 3, 1, 4, 2
(C) 3, 1, 5, 4, 2
(D) 1, 3, 5, 4, 2

70. Which of the following pairs is correctly matched regarding temperature-based groups?
(A) Pseudomonas species - Strict thermophiles
(B) Psychrophiles - Optimal growth at 37°C
(C) Thermophiles - Optimal growth at 15°C
(D) Listeria monocytogenes - Psychrotrophic pathogen

71. Which of the following statements about psychrotrophs is incorrect?
(A) They are primarily responsible for the spoilage of pasteurized milk kept at refrigeration temperatures.
(B) They are synonymous with psychrophiles in their absolute requirement for extremely cold temperatures.
(C) Their optimal growth temperature usually lies in the mesophilic range (20°C-30°C).
(D) They can cause significant shelf-life reduction in chilled meats.

72. A food processor wants to formulate a predictive microbiology model for the growth of Listeria monocytogenes in sliced turkey stored at 4°C. What fundamental concept must be applied?
(A) The model must account for the organism's psychrotrophic ability to bypass the lag phase rapidly under low-temperature conditions.
(B) The model should exclusively use thermal death D-values and thermal resistance Z-values to predict active kinetic growth rates.
(C) The model must rely on equations detailing optimal growth at 37°C adjusted downwards, accounting for its psychrotrophic nature.
(D) The model is completely irrelevant because Listeria species are physiologically unable to grow at any temperature below 10°C.

73. How is a psychrotroph formally defined in food microbiology?
(A) An organism that has an optimum growth temperature at or below 15°C and strictly cannot survive or replicate in environments above 20°C.
(B) A specialized, highly infectious foodborne pathogenic organism that exclusively targets and colonizes refrigerated raw agricultural produce.
(C) An organism that easily survives deep freezing processes but requires a subsequent mild thermal heat shock to initiate metabolic activity.
(D) An organism capable of active growth at refrigeration temperatures between 0°C and 7°C but possessing an optimum growth temperature above 20°C.

74. What is a primary cause-and-effect relationship of temperature fluctuation (thaw-refreeze cycles) in a freezer containing frozen vegetables?
(A) It causes physical cell damage to the food matrix and allows psychrotrophs to multiply during the thawed phase, reducing shelf life.
(B) It permanently and irreversibly lowers the optimal growth temperature of all resident mesophilic pathogens residing in the vegetable tissues.
(C) It leads directly to the rapid and uncontrollable proliferation of extreme halophilic archaea within the low-solute aqueous phase.
(D) It rapidly and effectively sanitizes the product through repeated cellular stress and continuous cold-shock protein synthesis cycles.

75. Which of the following pairs linking an organism to its temperature classification is incorrect?
(A) Pseudomonas fragi - Psychrotrophic spoiler
(B) Staphylococcus aureus - True psychrophile
(C) Listeria monocytogenes - Psychrotrophic pathogen
(D) Salmonella enterica - Mesophilic pathogen

76. The human body temperature is approximately 37°C. Which group of microorganisms has an optimal growth temperature that most closely matches this?
(A) Thermophiles
(B) Mesophiles
(C) Psychrophiles
(D) Hyperthermophiles

NODIA

77. Consider the following statements regarding mesophilic organisms relevant to food:
1. They encompass the vast majority of foodborne human pathogens.

a requirement for sodium, making them a risk in seafood.
4. Halotolerant pathogens are typically destroyed by standard freezing techniques.

Which of the above statement(s) is/are correct?
(A) 2 and 3
(B) 1 and 4
(C) 1, 2, and 3
(D) 2, 3, and 4

33. Which of the following correctly describes the role of acidophiles and alkalophiles in food environments?
(A) Acidophiles primarily cause spoilage in high-protein meats, while alkalophiles spoil fermented dairy.
(B) Acidophiles can survive and grow in extreme low pH foods like fruit juices and fermented products.
(C) Alkalophiles are often a major public health concern in processed foods with an ambient pH below 4.0.
(D) Both groups require absolute neutral pH values for cell division, vegetative growth, and sporulation.

34. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Staphylococcus aureus is a major hazard in cured and salted meats like ham and bacon.
Reason (R): It is a halotolerant pathogen capable of multiplying in environments with lowered water activity due to salt.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

35. A food safety officer investigates an outbreak linked to raw oysters. Laboratory analysis indicates the presence of a moderately halophilic, Gram-negative pathogen. Which organism is the most likely culprit?
(A) Vibrio parahaemolyticus
(B) Listeria monocytogenes
(C) Clostridium botulinum
(D) Salmonella Enteritidis

36. Match the items in List I with the items in List II:
List I: (Preservation Strategy)
P. Drying and dehydration
Q. Addition of high levels of sucrose
R. Addition of high levels of NaCl
S. Acidification (lowering pH)
List II: (Microbial Group)
I. Osmophiles
II. Xerophiles
III. Acidophiles
IV. Halophiles
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-IV, R-I, S-III

37. Which of the following microbial groups is NOT inherently adapted to survive in environments with low water activity (a_w)?
(A) True Psychrophiles
(B) Extreme Osmophiles
(C) Obligate Xerophiles
(D) Halophilic Bacteria

38. Consider the following statements:
Statement I: Cured and salted foods completely prevent the growth of all known foodborne pathogens.
Statement II: Halotolerant pathogens such as Staphylococcus aureus can still produce enterotoxins in salted foods if temperature abuse occurs.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

39. Arrange the following extreme environment adaptations in order of the corresponding typical minimum water activity (a_w) required for growth, from highest a_w to lowest a_w.
1. Typical mesophilic bacteria
2. Halophilic bacteria
3. Xerophilic molds
(A) 1, 2, 3
(B) 3, 2, 1
(C) 2, 1, 3
(D) 1, 3, 2

Click Here to Buy book on Amazon

held in a warmer at 45°C. What is the most appropriate competency-based intervention?
(A) Approve the practice immediately, as holding foods at 45°C is mathematically proven to be hot enough to denature and kill all thermophilic spores.
(B) Recommend lowering the holding temperature to 30°C, which is standard restaurant practice to slow down pathogenic microbial metabolic pathways.
(C) Issue a warning and require the temperature to be raised above 60°C, because 45°C is within the danger zone and allows mesophile survival/growth.
(D) Suggest transferring the curries to a blast chiller immediately, as holding cooked foods in warm display cases is always inherently unsafe.

85. Which of the following pairs accurately matches a mesophile characteristic?
(A) Spoilage role - Often cause putrefaction and souring at ambient temperatures
(B) Optimal growth - Rapidly replicate in thermal environments between 55°C and 65°C
(C) Pathogenic potential - Consist primarily of highly beneficial, harmless extremozymes
(D) Environmental source - Thrived historically near deep-sea benthic hydrothermal vents

86. Which of the following statements about mesophilic spore-formers is incorrect?
(A) Bacillus cereus includes mesophilic strains that cause food poisoning.
(B) Clostridium perfringens is a mesophilic spore-former often implicated in temperature-abused cooked meats.
(C) They require conditions within the danger zone for vegetative growth and toxin production.
(D) Their spores are completely destroyed by standard pasteurization (e.g., 72°C for 15 seconds).

87. In the context of hot holding standards for cooked foods, maintaining a temperature above 60°C is primarily aimed at preventing the outgrowth of which specific group?
(A) Psychrophilic spoilers
(B) Mesophilic pathogens
(C) Acidophilic bacteria
(D) Hyperthermophilic flora

88. What is the standard definition of a mesophile?
(A) An organism requiring high pressure and moderate temperatures for growth.
(B) An organism that exclusively survives in extreme pH and temperature fluctuations.
(C) An organism whose optimal growth temperature is between 20°C and 45°C.
(D) An organism adapted to grow only in environments with high sugar content.

89. A catering company cooks a large batch of stew, cools it inadequately, and then gently reheats it to 45°C before serving. What is the most likely cause-and-effect outcome?
(A) The gentle reheating will effectively destroy any pre-formed heat-stable mesophilic toxins and render the stew completely safe for consumption.
(B) The process will selectively trigger the genetic mutation and rapid growth of extremophilic barophilic bacteria in the liquid matrix.
(C) The mild heat applied during this step will physiologically convert psychrotrophic spoilers into harmless thermophilic vegetative cells.
(D) The inadequate cooling and mild reheating provide optimal environmental conditions for mesophilic spore germination and rapid bacterial multiplication.

90. Which of the following pairs linking microbial activity and temperature is incorrectly matched?
(A) Thermophile germination - Triggered consistently at 4°C
(B) Mesophile toxin production - Optimal around 37°C
(C) Psychrotroph multiplication - Occurs slowly at 4°C
(D) Hyperthermophile growth - Optimal above 80°C

NODIA

91. Which of the following microorganisms is classically associated with sulphide stinker spoilage in canned foods?
(A) Bacillus subtilis bacterium
(B) Desulfotomaculum nigrificans
(C) Clostridium botulinum species
(D) Lactobacillus acidophilus strain

92. Consider the following characteristics regarding flat sour spoilage in canned goods:
1. It is primarily caused by thermophilic organisms like Geobacillus

stearothermophilus.
2. The spoilage produces significant amounts of lactic acid.
3. The can bulges severely due to CO_2 and H_2 gas production.
4. The product exhibits a noticeably lowered pH.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

93. Which of the following statements correctly identifies the industrial relevance of thermophiles in canning?
(A) Because their spores are highly heat-resistant, thermal processing schedules for low-acid foods must be designed to either destroy them or store the cans below their germination temperature.
(B) Because they produce unique fermentation metabolites in low-acid canned foods, they are commonly inoculated by processing plants to enhance the overall sensory profile and consumer appeal.
(C) Because they are highly sensitive to moderate environments, they are completely destroyed by simple ambient cooling below 50°C, making post-retort refrigeration steps unnecessary.
(D) Because they share identical heat-death kinetics, they are widely used as active biological indicators during pasteurization to prove the absolute destruction of mesophilic pathogens.

94. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Rapid cooling of canned foods to below 40°C immediately after thermal processing is a critical control measure.
Reason (R): It prevents the germination and outgrowth of surviving thermophilic spores, which typically require temperatures above 45-50°C to grow.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

95. A canning facility processes sweet corn and stacks the processed cans on pallets in a warehouse without proper forced-air cooling. Weeks later, quality control finds many cans have a sour taste with no swelling. The most likely cause is:
(A) Incomplete thermal destruction of mesophilic pathogens during initial cooking.
(B) Post-process contamination through leaky container seams by cold-tolerant psychrotrophs.
(C) Sulphide stinker spoilage caused by thermophilic Clostridium thermosaccharolyticum.
(D) Flat sour spoilage due to thermophilic spore germination during extended warm storage.

96. Match the items in List I with the items in List II:
List I: (Organism)
P. Geobacillus stearothermophilus
Q. Clostridium thermosaccharolyticum
R. Desulfotomaculum nigrificans
S. Thermoanaerobacterium aethylicum
List II: (Defect)
I. Sulphide stinker spoilage (blackening, H_2S odor)
II. Flat sour spoilage (acid without gas)
III. Thermophilic anaerobic spoilage (acid and massive gas/swelling)
IV. Thermophilic spoilage producing hydrogen and ethanol
(A) P-II, Q-III, R-I, S-IV
(B) P-III, Q-II, R-IV, S-I
(C) P-I, Q-IV, R-III, S-II
(D) P-II, Q-I, R-III, S-IV

97. Which of the following conditions is NOT typically a cause of can swelling (hard swell or flipper)?
(A) Growth of Clostridium thermosaccharolyticum
(B) Flat sour spoilage
(C) Growth of putrefactive anaerobes
(D) Hydrogen production from internal can corrosion

98. Consider the following statements:
Statement I: Clostridium thermosaccharolyticum is a prominent cause of thermophilic anaerobic spoilage characterized by large amounts of gas production.
Statement II: Sulphide stinker spoilage also produces massive amounts of gas, causing the

Downloaded from www.pdf.tube

cans to burst.

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

99. As an FSO reviewing a thermal processing log for canned peas, you notice the cooling water temperature was too high, leaving the final product temperature at 55°C before warehousing. What is the most appropriate action?

(A) Quarantine the batch due to a high risk of thermophilic spoilage (e.g., flat sour).
(B) Release the product to distribution, as holding at 55°C kills all remaining bacteria.
(C) Order the batch to be frozen immediately in blast chillers to reverse any spoilage.
(D) Approve the batch because only mesophiles represent a concern in canned peas processing.

100. Which of the following pairs is correctly matched regarding canned food spoilage?

(A) Sulphide stinker - Production of high levels of carbon dioxide and hydrogen gas
(B) Flat sour - Significant structural bulging of the canned ends during storage
(C) Clostridium thermosaccharolyticum - Gaseous swelling and sour organic acid odor
(D) Geobacillus stearothermophilus - Severe chemical blackening of the food contents

101. Which of the following statements about hyperthermophiles is incorrect?

(A) They are widely recognized as frequent human foodborne pathogens.
(B) They have an optimum growth temperature typically above 80°C.
(C) Their enzymes, known as extremozymes, are highly valued in food biotechnology and industrial processes.
(D) They are often isolated from geothermal environments like hot springs and deep-sea vents.

102. In the calculation of a D-value for a thermophilic spore-former like Geobacillus stearothermophilus, which mathematical/environmental context is most relevant?

(A) Calculating the exponential growth rate and overall biomass yield at the standard physiological human incubation temperature of 37°C.
(B) Establishing the lowest critical pH limit at which the dehydrated bacterial endospores can successfully initiate germination pathways.
(C) Measuring the minimum mechanical hydrostatic pressure required to physically rupture and burst the protective outer spore coat structure.
(D) Determining the heating time required to achieve a 1-log reduction in population at a specific reference temperature, usually 121.1°C.

NODIA

103. What is the defining characteristic of a hyperthermophile?

(A) Growth strictly below 20°C with highly saturated membrane lipids.
(B) Optimal growth temperatures exceeding 80°C, often near the boiling point of water.
(C) An absolute requirement for high salt and high temperature simultaneously.
(D) The ability to survive thermal processing and subsequently cause flat sour spoilage at room temperature.

104. What is a direct cause-and-effect result of inadequate thermal processing in low-acid canned foods?

(A) It causes the rapid metabolic proliferation of extreme halophilic archaea inside the low-sodium canned food environment.
(B) It leads directly to the immediate, uncontrolled physical freezing of the entire liquid product food matrix during warehouse storage.
(C) It allows mesophilic and thermophilic spore-formers to survive, germinate, and cause spoilage or toxicity during storage.
(D) It forces the rapid physiological transformation of standard vegetative psychrotrophs into extreme hyperthermophilic strains.

105. Which of the following pairs linking an enzyme type to its thermal stability is incorrectly matched?

(A) Extremozymes from hyperthermophiles - Retain high activity at 90°C
(B) Standard mesophilic proteases - Rapidly denatured at 85°C

beyond its culinary recommended internal doneness temperature.
(C) Storing highly perishable, high-moisture foods continuously at theoretical temperatures near absolute zero.
(D) The temporary failure of restaurant inspectors to utilize a calibrated digital probe thermometer during safety audits.

134. A food service establishment cools a large stockpot of chili from 60°C to 21°C in 6 hours, and from 21°C to 5°C in another 6 hours. What is the most likely cause-and-effect consequence?
(A) The slow rate of cooling (cause) induces rapid lactic acid fermentation, effectively preserving the chili from spoilage (effect).
(B) The highly extended cooling period (cause) eliminates all psychrotrophic pathogens and vegetative spoilage bacteria completely (effect).
(C) The custom two-stage cooling process (cause) ensures the complete, absolute commercial sterility of the high-protein product (effect).
(D) The prolonged cooling time (cause) allows surviving spores to germinate and vegetative cells to rapidly multiply (effect).

135. Which of the following pairs linking a predictive model type to its application is incorrectly matched?
(A) Growth model - Predicting the time required for Listeria to reach a hazardous level in chilled meat.
(B) Survival model - Designing the packaging color to maximize consumer appeal.
(C) Inactivation model - Predicting the D-value of Salmonella during roasting.
(D) Probability model - Predicting the likelihood of spore germination under specific salt and pH conditions.

136. What is the defining environmental requirement for barophiles (piezophiles)?
(A) High osmotic pressure due to salt.
(B) High atmospheric oxygen concentrations.
(C) Extremely high hydrostatic pressure.
(D) Extremely low temperatures combined with high acidity.

137. Consider the following statements regarding hyperthermophiles and their enzymes in food biotechnology:
1. Extremozymes from hyperthermophiles are highly stable under extreme processing conditions.
2. They are utilized in starch hydrolysis (e.g., liquefaction) because they remain active at temperatures that reduce process viscosity.
3. Alpha-amylases from these organisms operate optimally below 30°C.
4. Their thermal stability reduces the risk of mesophilic microbial contamination during industrial processing.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

138. Which of the following is a correct statement regarding barophiles in food?
(A) They are primarily isolated from deep-sea habitats and are a consideration in deep-sea seafood products.
(B) They are commonly found growing on the surfaces of dehydrated agricultural products like sun-dried tomatoes.
(C) They cause extensive, rapid spoilage in high-acid commercially sterile canned goods stored on supermarket shelves.
(D) They cannot survive or carry out metabolic reactions in any food matrices containing high levels of free water.

139. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Deep-sea fish products can harbor spoilage organisms uniquely adapted to high pressure and low temperatures.
Reason (R): The deep ocean environment is characterized by high hydrostatic pressure and temperatures generally around 2°C to 3°C, selecting for psychrophilic piezophiles.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

140. A biotechnology firm is researching novel enzymes to use in a high-temperature industrial fruit juice clarification process operating at 85°C. From which microbial group should they prospect for these enzymes?

Click Here to Buy book on Amazon

Statement I: Fungi (molds and yeasts) are generally more tolerant of extreme low water activity environments than most bacteria.
Statement II: Xerophilic molds can grow on dried grains and cereals, potentially producing mycotoxins.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

114. You are tasked with reformulating a bakery filling to prevent the growth of Staphylococcus aureus without relying on refrigeration. Which competency-based approach uses the hurdle concept involving extremophile biology?
(A) Increasing the food product's pH to 8.0 or higher to actively promote the competitive growth of alkaline-loving alkalophiles.
(B) Adding active cold-adapted psychrophilic enzymes to the filling matrix to biochemically and competitively exclude the pathogen.
(C) Storing the finished product under extreme hydrostatic pressure within a retort vessel to fully mimic deep-sea barophilic conditions.
(D) Lowering the water activity (a_w) below 0.85 using sugar and salt to exceed the pathogen's halotolerant/osmotolerant limits.

115. Which of the following pairs linking an extremophile category to its approximate minimal growth water activity (a_w) is correctly matched?
(A) Xerophilic molds - a_w 0.61
(B) Normal mesophilic bacteria - a_w 0.70
(C) Extreme halophilic bacteria - a_w 0.75
(D) Osmophilic yeasts - a_w 0.95

116. Which of the following statements about acidophiles in food environments is incorrect?
(A) They thrive in low pH foods like fruit juices and fermented vegetables.
(B) Alicyclobacillus acidoterrestris is a spore-forming acidophile that causes spoilage in pasteurized fruit juices.
(C) They are highly susceptible to spoilage by halophiles in high-acid conditions.
(D) Many lactic acid bacteria exhibit acidophilic or acid-tolerant properties.

117. How does an extreme pH environment (e.g., pH < 4.0) practically interact with heat resistance in processing?
(A) Low pH reduces the D-value of bacterial spores, allowing for milder thermal processing (e.g., a boiling water bath).
(B) Low pH significantly increases the heat resistance of thermophilic spores in high-solute canning operations.
(C) Extreme acidity induces heat-shock protein synthesis, making standard commercial pasteurization completely ineffective.
(D) Substrate pH has no mathematical or practical effect on the thermal death time calculations of target pathogens.

118. What defines an osmophile in food science?
(A) An organism that requires exceptionally high atmospheric oxygen tensions to actively maintain its internal osmotic balance.
(B) A highly infectious pathogen that can only survive and multiply in pure aqueous environments completely devoid of solutes.
(C) A specialized xerophilic mold that grows exclusively on dehydrated, unsweetened animal muscle tissues and meat products.
(D) An organism adapted to survive in environments with high osmotic pressures, typically due to elevated sugar concentrations.

119. What is the cause-and-effect relationship of placing a typical mesophilic, non-halotolerant bacterial cell into a 20% NaCl brine?
(A) The brine causes water to enter the cell rapidly via osmosis (cause), leading directly to turgor pressure overload and cellular lysis (effect).
(B) The hypertonic environment causes water to exit the cell via osmosis (cause), leading to plasmolysis and growth inhibition (effect).
(C) The extreme sodium concentration denatures key extracellular enzymes (cause), prompting the immediate onset of rapid sporulation (effect).
(D) The excess sodium ions substitute for potassium in the lipid bilayer (cause), creating a highly specific, permanent halophilic mutation (effect).

120. Which of the following pairs linking an extreme environment to a microbial adaptation is incorrectly matched?
(A) Low water activity - Accumulation of

Downloaded from www.pdf.tube

greatest innate resistance to this specific process mechanism?
(A) Barophiles (Piezophiles)
(B) Extreme acidophilic flora
(C) True psychrophilic mold
(D) Osmophilic yeast strains

148. What defines an alkalophile in a food environment?
(A) An organism that optimally grows at a pH below 4.0.
(B) An organism that requires an environment devoid of oxygen.
(C) An organism that optimally grows at a pH above 9.0.
(D) An organism that grows strictly in pure ethanol.

149. What is a primary cause-and-effect relationship regarding hyperthermophile protein structures?
(A) Increased numbers of internal hydrogen bonds and salt bridges (cause) result in extreme thermal stability of their enzymes (effect).
(B) A lack of standard peptide bonds and essential amino acids (cause) makes their overall protein structures invisible to heat (effect).
(C) High levels of polyunsaturated lipid structures inside the folding protein (cause) prevent thermal denaturation at high temperatures (effect).
(D) Continuous metabolic exposure to active cold shock proteins (cause) allows vegetative cellular envelopes to survive rapid boiling (effect).

150. Which of the following pairs linking a microbial group to a typical food vehicle is incorrectly matched?
(A) Psychrotrophs - Chilled ready-to-eat meals
(B) Thermophiles - Processed low-acid canned foods
(C) Halophiles - Fermented soy sauces and salted fish
(D) Hyperthermophiles - Refrigerated pasteurized milk

NODIA

(A) P-II, Q-III, R-I, S-IV
(B) P-III, Q-II, R-I, S-IV
(C) P-II, Q-I, R-III, S-IV
(D) P-I, Q-II, R-IV, S-III

127. Which of the following is NOT typically considered a Critical Limit for temperature control in a HACCP plan?
(A) Cooking raw poultry portions until they achieve a safe internal target temperature of 74°C.
(B) Storing highly perishable, chilled high-risk food items continuously at or below 5°C.
(C) Maintaining hot-held ready-to-eat buffet food items continuously above 60°C.
(D) Allowing the warehouse temperature for canned goods to fluctuate between 30°C and 45°C.

128. Consider the following statements:
Statement I: Time-Temperature Indicators (TTIs) are smart labels affixed to packaging that show a visual change indicating accumulated thermal exposure.
Statement II: TTIs are specifically designed to physically cool the product if the temperature rises above 5°C.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

129. A logistics manager wants to implement a system to instantly alert receivers if a pallet of fresh fish was subjected to temperature abuse during a 3-day transit. Which competency-based solution is most effective?
(A) Performing an aerobic plate count on-site upon arrival, prior to starting the physical unloading process.
(B) Utilizing digital temperature data loggers and smart Time-Temperature Indicators (TTIs) on the pallets.
(C) Checking the superficial surface temperature of random fish using an infrared thermometer immediately upon arrival.
(D) Requiring the transport truck driver to sign a manual paper logbook verifying the temperature was fine throughout.

130. Which of the following pairs is correctly matched regarding temperature monitoring devices?
(A) Bimetallic stem thermometer - Continuous remote cloud-based data logging
(B) Infrared thermometer - Accurately measures the thermal center of thick foods
(C) Time-Temperature Indicator (TTI) - Validates the sterilization temperature inside a retort
(D) Thermocouple - Rapid response internal temperature measurement

131. Which of the following statements about cold chain logistics is incorrect?
(A) A breakdown in the cold chain is usually reversible by simply freezing the product afterwards.
(B) Its primary goal is to maintain the product's quality and microbiological safety.
(C) It encompasses storage, transportation, and retail display phases.
(D) Strict adherence to the cold chain slows the physiological processes of both the food and the spoilage microflora.

132. In a predictive microbiology growth curve graphing log(CFU/g) versus time for a mesophile at 37°C versus 15°C, what is the expected conceptual difference?
(A) The curve at 15°C will show immediate, steep exponential growth, while the 37°C growth curve will remain completely flat during monitoring.
(B) The maximum population density (N_{max}) of the target organism at 15°C will always be exactly tenfold higher than at the optimal 37°C.
(C) At 15°C, the lag phase will be significantly longer, and the slope of the exponential phase (growth rate) will be less steep than at 37°C.
(D) There will be no observable growth kinetics difference; temperature changes only affect spore germination and not vegetative growth curves.

133. Which of the following definitions best captures "time-temperature abuse" in the context of foodborne illness?
(A) Keeping TCS foods in the danger zone long enough to allow pathogen multiplication or toxin production.
(B) Heating a perishable food product significantly

Click Here to Buy book on Amazon

compatible intracellular solutes (e.g., glycerol or proline)
(B) Cold temperatures - Increase in membrane unsaturated fatty acids
(C) High temperatures - Enzymes with highly flexible, easily denatured structures
(D) High hydrostatic pressure - Modification of porins and membrane structures to maintain fluidity

121. What is the universally recognized lower limit of the temperature Danger Zone in food safety regulations?
(A) 0°C
(B) 10°C
(C) 15°C
(D) 5°C

122. Consider the following factors used in primary predictive microbiology models for temperature-dependent growth:
1. Lag phase duration (λ).
2. Specific maximum growth rate (μ_{max}).
3. The color of the packaging material.
4. Maximum population density (N_{max}).

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 2, 3, and 4
(C) 1, 3, and 4
(D) 1, 2, and 3

123. Which of the following is a correct statement regarding temperature monitoring in the cold chain?
(A) Manual temperature checks performed once a day are completely sufficient to guarantee safety in complex international cold chain logistics networks.
(B) Continuous automated temperature monitoring and data logging are critical for verifying that food has not entered the danger zone during transport.
(C) Temperature monitoring and continuous recording are only legally mandated for deeply frozen foods, not for standard chilled refrigerated products.
(D) Smart Time-Temperature Indicators (TTIs) attached to pallets completely eliminate the legal requirement for maintaining standard HACCP documentation.

124. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Freezing food to -18°C reliably kills all foodborne bacterial pathogens.
Reason (R): The formation of ice crystals irreparably ruptures the cell membranes of all microbial cells.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

125. A food safety team is validating a new cooking process for large roast beef joints. They map the internal temperature over time. To ensure lethality against vegetative pathogens, which critical parameters must they evaluate together?
(A) The minimum internal core temperature and the continuous time the thermal center is maintained at or above that level.
(B) Maximum oven surface temperature combined with the relative humidity profile of the circulating air during heating.
(C) The rapid cooling rate measured strictly and solely within the critical high-temperature range between 100°C and 80°C.
(D) The surrounding localized barometric pressure and the exact thermal freezing point of the specific beef cut.

126. Match the items in List I with the items in List II:
List I: (Model Level)
P. Primary model
Q. Secondary model
R. Tertiary model
S. Validation model
List II: (Description)
I. User-friendly software interfaces (e.g., ComBase, Pathogen Modeling Program) integrating algorithms.
II. Describes microbial numbers changing over time under constant environmental conditions (e.g., Gompertz equation).
III. Describes how parameters like growth rate change in response to environmental factors like temperature (e.g., Ratkowsky equation).
IV. Comparing model predictions against independent experimental data in real food matrices.

NODIA

(A) Psychrotrophs
(B) Hyperthermophiles
(C) Halophiles
(D) Alkalophiles

141. Match the items in List I with the items in List II:
List I: (Microbial Classification)
P. Thermoduric
Q. Psychrotrophic
R. Piezophilic (Barophilic)
S. Osmophilic
List II: (Adaptation/Relevance)
I. Capable of surviving pasteurization though not necessarily growing at high temperatures.
II. Capable of growth at refrigeration temperatures but with mesophilic optima.
III. Dependent on or highly tolerant of extreme hydrostatic pressure.
IV. Thrives in environments with high solute (sugar) concentrations.
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-I, R-IV, S-III
(C) P-IV, Q-III, R-II, S-I
(D) P-I, Q-III, R-II, S-IV

142. Which of the following is NOT an advantage of using extremozymes from hyperthermophiles in food biotechnology?
(A) Increased resistance to thermal denaturation.
(B) Higher operational temperatures leading to faster reaction rates.
(C) Decreased solubility of polymeric substrates at high temperatures.
(D) Complete inactivation at standard room temperatures preventing post-processing reactions.

143. Consider the following statements:
Statement I: The discovery of Taq polymerase, a heat-stable DNA polymerase, revolutionized molecular biology, though its primary origin is a hyperthermophile.
Statement II: Similar heat-stable enzymes are used in the food industry to process starch and complex carbohydrates at elevated temperatures.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

144. Outbreak of illness is traced to a pasta salad. Epidemiological data show it was held at 4°C for three days, then left at 30°C for six hours before consumption. Testing reveals high levels of both Listeria monocytogenes and Staphylococcus aureus. Based on competency in microbial temperature behavior, how did this mixed abuse contribute?
(A) Both pathogens multiplied exclusively during the final 30°C holding period while background microflora were entirely inactive.
(B) S. aureus grew actively at 4°C due to its psychrophilic genes, while Listeria multiplied rapidly during the 30°C exposure.
(C) Listeria slowly grew during the 4°C phase (psychrotrophic), while S. aureus multiplied and produced toxin at 30°C (mesophilic).
(D) The initial 4°C holding period caused both vegetative pathogens to sporulate, only germinating upon subsequent human ingestion.

145. Which of the following pairs correctly summarizes the optimum growth temperature ranges for major groups?
(A) Psychrophiles: 20-30°C | Mesophiles: 30-45°C | Thermophiles: >80°C
(B) Psychrophiles: <15°C | Mesophiles: 20-45°C | Thermophiles: 50-70°C
(C) Psychrophiles: <0°C | Mesophiles: 10-20°C | Thermophiles: 40-50°C
(D) Psychrophiles: 15-25°C | Mesophiles: 25-55°C | Thermophiles: 55-85°C

146. Which of the following statements about piezophiles is incorrect?
(A) They are synonymous with barophiles.
(B) Their cell membranes have adapted to remain fluid under extreme pressure.
(C) They are relevant to the microbiology of seafood harvested from extreme ocean depths.
(D) They are identical to xerophiles in their fundamental physiological adaptations.

147. High Pressure Processing (HPP) is a non-thermal food preservation technique that subjects food to extreme hydrostatic pressures (e.g., 600 MPa) to inactivate pathogens. Which group of microorganisms would theoretically possess the

Downloaded from www.pdf.tube

(C) Thermophilic amylases - Used in high-temperature starch hydrolysis
(D) Psychrophilic lipases - Highly stable and hyperactive at 100°C

106. Which of the following definitions best describes a xerophile?
(A) A microorganism adapted to grow in extremely low water activity (a_w) environments, such as dried foods.
(B) A microorganism that grows optimally in deep marine environments characterized by extremely high hydrostatic pressure.
(C) A microorganism that strictly requires a highly alkaline chemical environment exceeding pH 9.0 to grow and survive.
(D) A microorganism that thrives exclusively in hyper-saline brines and requires high levels of sodium chloride.

107. Consider the following statements regarding salt-tolerant and halophilic microorganisms:
1. True halophiles require sodium chloride for structural stability and growth.
2. Halotolerant organisms do not require salt but can grow under moderate to high saline conditions.
3. Staphylococcus aureus is a notable halotolerant pathogen.
4. All halophiles are destroyed by lowering the water activity with salt.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 1, 2, and 3
(D) 2, 3, and 4

108. Which of the following is a correct statement regarding osmophiles?
(A) They are primarily responsible for the rapid proteolytic spoilage of fresh animal meats, poultry, and raw seafood.
(B) They are specialized microorganisms, often yeasts, that thrive and multiply in environments with high sugar concentrations.
(C) They are highly sensitive to environments characterized by elevated osmotic pressure and high concentrations of solutes.
(D) They require a very high minimum water activity of exactly 0.98 in order to initiate vegetative cell replication.

109. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Honey rarely spoils from bacterial growth, but can occasionally ferment.
Reason (R): Honey has a very low water activity due to high sugar content, inhibiting most bacteria, but certain osmophilic yeasts can survive and grow in it.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

110. A fruit jam manufacturer receives complaints that their sealed jars are bubbling and developing an alcohol-like odor shortly after distribution. The pH of the jam is 3.5 and the sugar concentration is 65%. Which microbial group is the definitive cause?
(A) Alkalophiles
(B) Thermophilic spore-forming bacteria
(C) Osmophilic yeasts
(D) Halotolerant bacteria

111. Match the items in List I with the items in List II:
List I: (Food Environment)
P. Soy sauce (15-18% NaCl)
Q. Dried milk powder ($a_w < 0.6$)
R. Maple syrup (high sucrose)
S. Pickled onions (pH 3.0)
List II: (Microbial Group)
I. Acidophiles
II. Xerophiles
III. Osmophiles
IV. Extreme halophiles
(A) P-IV, Q-II, R-III, S-I
(B) P-II, Q-IV, R-I, S-III
(C) P-IV, Q-III, R-II, S-I
(D) P-I, Q-II, R-IV, S-III

112. Which of the following organisms is NOT typically able to grow in high salt (low water activity) environments?
(A) Vibrio parahaemolyticus
(B) Staphylococcus aureus
(C) Campylobacter jejuni
(D) Halobacterium species

113. Consider the following statements:

NODIA

ANSWERS

1. (B) 15°C or lower
True psychrophiles are cold adapted microorganisms specifically structured to survive and multiply in permanently cold environments. These unique organisms exhibit an optimal growth temperature of fifteen degrees Celsius or lower, a maximum growth temperature below twenty degrees Celsius, and a minimum growth temperature near zero degrees Celsius. Their cell membranes contain high amounts of unsaturated fatty acid molecules.

2. (A) 1, 2, and 4
Psychrotrophic microorganisms are mesophilic organisms capable of growing at low refrigeration temperatures, typically between zero and seven degrees Celsius. Prominent examples include Pseudomonas species, which cause spoilage in protein-rich foods, and Listeria monocytogenes, a major foodborne pathogen. Unlike psychrophiles, psychrotrophs grow optimally at warm ambient temperatures and successfully inhabit environments above ten degrees Celsius.

3. (A) Psychrotrophs grow at 0–7°C with mesophilic optima, while psychrophiles grow optimally at 15°C or lower.
Psychrotrophs and psychrophiles possess distinct temperature profiles that affect food preservation. Psychrotrophs are cold-tolerant organisms with an optimal growth temperature in the mesophilic range but capable of multiplying at zero to seven degrees Celsius. Conversely, true psychrophiles are obligate cold-loving organisms that grow optimally at fifteen degrees Celsius or lower and cannot survive at room temperatures.

4. (A) Both A and R are true and R is the correct explanation of A.
Standard domestic and commercial refrigeration slows the growth of most foodborne pathogens but cannot completely prevent food spoilage or safety hazards over extended periods. This limitation exists because psychrotrophic pathogens, such as Listeria monocytogenes, possess physiological adaptations that allow active replication at refrigeration temperatures. Consequently, auxiliary food preservation hurdles must be implemented to ensure microbiological safety.

5. (A) Psychrotrophic spoilers like Pseudomonas
Pasteurized milk stored under refrigeration is highly susceptible to spoilage by psychrotrophic bacteria, predominantly Pseudomonas species. These microorganisms enter the milk post-pasteurization and synthesize heat-stable extracellular lipases and proteases. These enzymes actively degrade milk lipids and proteins at four degrees Celsius, leading to bitter off-flavors, physical defects, and premature product coagulation before the designated shelf life.

6. (A) P-IV, Q-II, R-III, S-I
Microorganisms are categorized into distinct thermal groups based on their optimal growth ranges. Psychrophiles grow optimally at fifteen degrees Celsius or lower. Mesophiles, including most foodborne pathogens, thrive around thirty-seven degrees Celsius. Thermophiles prefer elevated temperatures between fifty-five and sixty-five degrees Celsius. Finally, hyperthermophiles are extreme heat-tolerant organisms with optimal growth occurring above eighty degrees Celsius.

7. (B) Clostridium thermosaccharolyticum
Mesophiles are organisms that grow optimally at moderate temperatures between twenty and forty-five degrees Celsius, including Salmonella enterica, Escherichia coli, and Staphylococcus aureus. Conversely, Clostridium thermosaccharolyticum is an obligate thermophile that thrives at much higher temperatures, specifically between fifty-five and sixty-five degrees Celsius, where it causes gaseous spoilage in processed canned products.

8. (A) Both Statement I and Statement II are correct.
The temperature range between five and sixty degrees Celsius represents the danger zone in food safety guidelines. Within this thermal window, environmental conditions are highly favorable for the rapid proliferation of mesophilic foodborne pathogens and spoilage organisms. Leaving perishable foods within this range encourages exponential bacterial multiplication, which increases the likelihood of foodborne infections and toxin production.

Click Here to Buy book on Amazon

80. (C) Mesophiles
Leaving potato salad at thirty degrees Celsius for five hours provides an ideal environment for mesophilic bacteria. This temperature is highly favorable for their growth, allowing rapid replication. Pathogens like Staphylococcus aureus or Bacillus cereus can multiply exponentially and produce toxins under these conditions, leading to acute gastrointestinal distress in individuals who consume the abused food.

81. (A) P-I, Q-II, R-IV, S-III
Pathogens display distinct physiological and behavioral characteristics in food systems. Campylobacter jejuni is a mesophile with an optimal growth temperature near forty-two degrees Celsius. Listeria monocytogenes is a psychrotrophic pathogen that multiplies in chilled ready-to-eat foods. Clostridium botulinum is a mesophilic spore-former, and Yersinia enterocolitica is a psychrotrophic pathogen commonly associated with pork.

82. (D) Geobacillus stearothermophilus
Mesophilic pathogens, such as Shigella dysenteriae, Vibrio cholerae, and Escherichia coli, grow optimally at moderate temperatures. In contrast, Geobacillus stearothermophilus is a classic thermophilic spore-former. This organism thrives at much higher temperatures, with an optimal growth range between fifty-five and sixty-five degrees Celsius, and it does not cause infection in humans at body temperature.

83. (C) Statement I is correct but Statement II is incorrect.
The lag phase of a mesophilic pathogen is significantly longer at ten degrees Celsius than at thirty-five degrees Celsius because cold temperatures slow metabolic processes. However, exposing mesophilic cells to temperatures below their minimum growth limit does not cause instantaneous death. Instead, it typically halts multiplication, leaving the cells viable but dormant for extended periods.

84. (C) Issue a warning and require the temperature to be raised above 60°C, because 45°C is within the danger zone and allows mesophile survival/ growth.
Holding cooked curries at forty-five degrees Celsius is a critical food safety violation because this temperature falls within the danger zone. This warm environment allows surviving mesophilic pathogens to survive and multiply. To prevent microbial growth, the holding temperature must be raised above sixty degrees Celsius, which is high enough to inhibit the replication of mesophiles.

85. (A) Spoilage role - Often cause putrefaction and souring at ambient temperatures
Mesophilic microorganisms play a major role in food spoilage under ambient conditions. When foods are stored at room temperature, mesophiles cause rapid putrefaction, souring, and off-odors by fermenting sugars and degrading proteins. These organisms grow optimally at moderate temperatures rather than high thermal ranges, and they represent common environmental contaminants rather than deep-sea extremophiles.

86. (D) Their spores are completely destroyed by standard pasteurization (e.g., 72°C for 15 seconds).
Mesophilic spore-formers like Bacillus cereus and Clostridium perfringens pose significant food safety challenges. These organisms require danger zone temperatures for vegetative growth and toxin production. While standard pasteurization at seventy-two degrees Celsius destroys vegetative cells, it does not destroy their highly resistant endspores, which can survive the heating process and germinate during subsequent cooling.

87. (B) Mesophilic pathogens
Maintaining a hot holding temperature above sixty degrees Celsius is a standard food safety practice. This high temperature is designed to prevent the growth of mesophilic pathogens, which thrive at moderate temperatures up to forty-five degrees Celsius. Keeping foods above this threshold ensures that any surviving vegetative cells cannot multiply, protecting consumers from foodborne illness.

88. (C) An organism whose optimal growth temperature is between 20°C and 45°C.
A mesophile is scientifically defined as an organism that grows optimally at moderate temperatures, typically between twenty and forty-five degrees Celsius. This group includes a wide variety of environmental bacteria, fungi, and the vast majority of human pathogens. They do not require extreme conditions such as high pressure, extreme acidity, or high salinity to replicate.

89. (D) The inadequate cooling and mild reheating provide optimal environmental conditions for

NODIA

18. (D) It is a thermophilic obligate anaerobe known to cause gaseous spoilage and hard swells in canned foods.
Clostridium thermosaccharolyticum is a thermophilic, spore-forming, obligate anaerobe capable of causing gaseous spoilage in canned foods. When cans are stored at elevated temperatures, the surviving spores of this organism germinate and ferment sugars. This activity produces large volumes of carbon dioxide and hydrogen gas, resulting in severe container swelling known as a hard swell or blower.

19. (A) Both A and R are true and R is the correct explanation of A.
Sulphide stinker spoilage is a distinct canning defect characterized by a blackened appearance and a strong rotten-egg odor. This condition is caused by Desulfotomaculum nigrificans, a thermophilic spore-former. The highly heat-resistant spores survive retort processing and subsequently germinate during warm storage, reducing sulfur compounds to hydrogen sulfide gas, which reacts with metal to form iron sulfide.

20. (C) Flat sour spoilage by thermophiles
Storing low-acid canned peas at an elevated temperature of forty-eight degrees Celsius stimulates the germination of surviving thermophilic spores. The resulting vegetative cells ferment the carbohydrates, generating organic acids that sour the product. Because no gas is produced during this fermentation, the can ends remain flat, making this a classic example of thermophilic flat sour spoilage.

21. (A) P-IV, Q-III, R-II, S-I
Extremophilic microorganisms are adapted to specific harsh food environments. Halophiles require high sodium chloride concentrations, making them spoilers of salted fish. Xerophiles tolerate very low moisture, thriving on dried foods. Osmophiles withstand high osmotic pressure, growing in high-sugar syrups. Finally, acidophiles are adapted to low pH environments, allowing them to survive and grow in fermented fruit juices.

22. (D) Fermenting refrigerated dairy products to produce yogurt.
Hyperthermophiles are extreme heat-tolerant organisms that grow optimally above eighty degrees Celsius. In biotechnology, they provide thermostable enzymes like amylases and proteases for high-temperature industrial processes. However, these organisms are completely inactive at low temperatures and cannot be used to ferment refrigerated dairy products, which relies on mesophilic or thermophilic lactic acid bacteria instead.

23. (D) Statement I is incorrect but Statement II is correct.
Hyperthermophiles are defined by their ability to grow optimally at extreme temperatures exceeding eighty degrees Celsius. Because of this adaptation, enzymes isolated from these organisms, known as extremozymes, possess remarkable thermal stability. These enzymes resist denaturation and remain highly active at standard pasteurization temperatures, making them highly valuable tools for continuous high-temperature food biotechnology applications.

24. (A) 1, 2, 3
The thermal death time, represented by the D-value, varies significantly among microbial groups. Vegetative cells of mesophilic non-spore-forming bacteria have the lowest heat resistance. Mesophilic bacterial endspores, such as those of Clostridium botulinum, exhibit much greater thermal tolerance. The highest heat resistance is found in thermophilic spore-formers like Geobacillus stearothermophilus, which require severe retorting temperatures for inactivation.

25. (D) Staphylococcus aureus - Halotolerance
Pathogenic microorganisms employ specific physiological mechanisms to survive environmental stressors in food. Staphylococcus aureus is exceptionally halotolerant, allowing it to grow and produce enterotoxins in foods with high salt concentrations and low water activity, such as cured meats. Other pathogens, like Vibrio parahaemolyticus and Salmonella, lack these specific extreme tolerance adaptations under standard processing conditions.

26. (A) Osmophiles are primarily found in high-protein, low-sugar environments like fresh fish.
Osmophiles are specialized microorganisms, typically yeasts, adapted to thrive in high-solute environments with high osmotic pressure, such as high-sugar syrups, jams, and honey. They are not associated with fresh fish, which is a high-protein, low-sugar environment. Conversely, dried agricultural commodities are primarily susceptible

NODIA

9. (A) 3, 2, 1, 4
Microorganisms are classified systematically based on their temperature requirements for growth. Under this scheme, psychrophiles exhibit the lowest optimal growth temperatures, followed by mesophiles, which thrive at intermediate ambient ranges. Thermophiles require elevated temperatures, and hyperthermophiles possess the highest optimal temperatures, exceeding eighty degrees Celsius. This precise sequence demonstrates the progressive thermal adaptation of different biological groups.

10. (A) Clostridium thermosaccharolyticum - Gaseous spoilage in high-temperature stored foods
Clostridium thermosaccharolyticum is a thermophilic, spore-forming, obligate anaerobe that causes gaseous spoilage in canned foods stored at high temperatures. During growth, it ferments carbohydrates to produce organic acids along with large quantities of hydrogen and carbon dioxide gases. This gas accumulation leads to severe swelling of the cans, representing a significant industrial defect in food processing.

11. (B) They are the primary agents of flat sour spoilage in commercially sterile canned foods.
Mesophilic microorganisms have an optimum growth temperature between twenty and forty-five degrees Celsius and include almost all human pathogens. However, flat sour spoilage in commercially sterile canned foods is caused by thermophilic spore-formers, such as Geobacillus stearothermophilus, rather than mesophiles. These thermophilic bacteria survive processing and produce acid without gas during warm storage.

12. (B) Mesophilic pathogens
Leaving cooked rice to cool slowly at an ambient room temperature of twenty-five degrees Celsius creates an ideal environment for mesophilic pathogens. These organisms, including Bacillus cereus, proliferate rapidly under such warm, moist conditions. Rapid cooling is therefore necessary to prevent these bacteria from exiting the lag phase, multiplying exponentially, and producing heat-stable emetic toxins that cause food poisoning.

13. (A) An organism with an optimum growth temperature generally between 50°C and 70°C.
Thermophilic microorganisms are characterized by their ability to thrive at elevated temperatures, typically displaying an optimum growth range between fifty and seventy degrees Celsius. These organisms produce highly stable proteins and cell membranes that resist thermal denaturation. They are of major concern in the canning industry, where their heat-resistant spores can survive commercial sterilization processes.

14. (C) Temperature abuse allows surviving mesophilic and psychrotrophic microbes to exit the lag phase and multiply.
Failing to rapidly cool freshly pasteurized milk before transport represents severe temperature abuse. This lack of temperature control creates favorable conditions that allow surviving mesophilic and psychrotrophic microorganisms to transition out of the lag phase and enter exponential growth. Consequently, these bacteria multiply rapidly, leading to elevated microbial counts and accelerated spoilage of the liquid dairy matrix.

15. (D) Sugar-rich foods - Barophiles
Microbial groups are associated with specific environmental niches based on their physiological adaptations. Alkalophiles inhabit high pH environments, halophiles thrive in salted foods, and psychrotrophs spoil refrigerated meats. However, sugar-rich foods are characterized by high osmotic pressure rather than high hydrostatic pressure. Therefore, they are targeted by osmophiles, whereas barophiles require extreme hydrostatic pressures found in deep oceans.

16. (C) Flat sour spoilage
Flat sour spoilage is a classic defect in canned foods caused by thermophilic spore-forming bacteria such as Geobacillus stearothermophilus. These organisms ferment carbohydrates to produce lactic acid, which significantly lowers the product pH. Because this metabolic process does not generate carbon dioxide or hydrogen gas, the can ends remain flat and do not exhibit any visible bulging.

17. (A) 1, 2, and 4
Flat sour spoilage occurs in canned foods when obligate or facultative thermophilic spore-formers survive thermal processing and germinate. This defect is characterized by significant acid production, which lowers the food pH while the container ends remain completely flat. It is typically caused by inadequate cooling of the cans after retorting, allowing the warm contents to encourage thermophilic outgrowth.

Downloaded from www.pdf.tube

36. (A) P-II, Q-I, R-IV, S-III
Food preservation methods target specific microbial groups by altering environmental conditions. Dehydration and drying lower water activity, selecting for xerophiles. Adding high levels of sucrose creates high osmotic pressure, selecting for osmophiles. High concentrations of sodium chloride require halophilic adaptations. Finally, acidification lowers the pH, creating an environment where only acidophilic or acid-tolerant microbes can grow.

37. (A) True Psychrophiles
Microorganisms vary in their ability to tolerate low water activity. Extreme osmophiles, obligate xerophiles, and halophilic bacteria possess specific physiological adaptations, such as accumulating intracellular compatible solutes, to survive and grow in low water activity environments. In contrast, true psychrophiles are adapted to low temperatures but generally require high water activity levels to support their growth.

38. (D) Statement I is incorrect but Statement II is correct.
Salting and curing foods lowers water activity but does not completely prevent the growth of all foodborne pathogens. Halotolerant pathogens like Staphylococcus aureus can survive and multiply in these high-salt environments. If temperature abuse occurs, these bacteria can grow and produce heat-stable enterotoxins, posing a serious health hazard to consumers despite the presence of salt.

39. (A) 1, 2, 3
Microbial groups exhibit different minimum water activity thresholds for growth. Typical mesophilic bacteria require high moisture levels, with a minimum water activity of around point nine zero. Halophilic bacteria are adapted to drier, high-salt conditions, surviving down to point seven five. Xerophilic molds are the most tolerant, capable of growing at water activities as low as point six one.

40. (C) Acidophiles - Fermented yogurt and kefir
Food environments with extreme pH select for specialized microorganisms. Fermented dairy products like yogurt and kefir are highly acidic, providing an ideal niche for acidophiles, such as lactic acid bacteria, which thrive in low pH conditions. Conversely, alkalophiles require basic environments, and halophiles require high salt, which does not match the characteristics of typical acidic fruit juices or egg products.

41. (D) Fluctuating temperatures during transport exclusively affect physical sensory properties, not overall microbial safety.
Temperature abuse during food handling allows products to enter the danger zone, facilitating rapid pathogen multiplication and toxin production. While fluctuating temperatures alter sensory properties, they also directly compromise microbial safety by enabling the outgrowth of pathogens and spores. Temperature fluctuations during transport can lead to localized condensation and warm spots, promoting rapid microbial growth and spoiling food.

42. (A) Cold chain integrity
A temporary temperature rise to twenty-two degrees Celsius during transit directly violates the principle of cold chain integrity. The cold chain requires continuous temperature control from production through distribution to retail. Breaking this temperature barrier allows refrigerated foods to warm up, facilitating the rapid growth of psychrotrophic spoilers and mesophilic pathogens, which compromises both safety and shelf life.

NODIA

43. (B) 5°C to 60°C
The temperature danger zone is defined as the range between five and sixty degrees Celsius. Within this specific temperature span, mesophilic foodborne pathogens can multiply rapidly and produce harmful toxins. Food safety regulations require that perishable foods be kept outside this range through cold holding below five degrees Celsius or hot holding above sixty degrees Celsius.

44. (B) Enforcing critical temperature limits (cause) prevents or slows the multiplication of foodborne pathogens to dangerous levels (effect).
In a Hazard Analysis Critical Control Point plan, temperature control acts as a critical preventive measure. Establishing and monitoring critical temperature limits (cause) directly halts or significantly reduces the metabolic activity and replication rate of foodborne pathogens (effect). This control prevents microbial populations from reaching levels that could cause illness, thereby ensuring the overall safety of the food product.

45. (A) D-value - The temperature required to destroy 90% of a microbial population in one minute
Processing concepts must be defined accurately in food safety. The D-value is the time, not the temperature, required to achieve a ninety percent

to spoilage by xerophilic molds adapted to low water activity levels.

27. (B) Osmophiles
A high sugar concentration of sixty-five percent exerts severe osmotic pressure, which inhibits the growth of most conventional spoilage bacteria. However, osmophilic microorganisms, particularly specialized yeasts, are physiologically adapted to survive and multiply in high-solute matrices. These organisms actively ferment sugars, producing carbon dioxide gas and alcohol, which leads to bubbling and spoilage of fruit preserves.

28. (B) A microorganism that requires high concentrations of sodium chloride for optimal growth.
A halophile is defined as an organism that requires high concentrations of sodium chloride to maintain cell membrane integrity, enzyme function, and cellular replication. These specialized organisms are categorized as slight, moderate, or extreme based on their specific salt requirements, and they are commonly isolated from hyper-saline environments and salted foods like cured fish.

29. (A) The extreme hydrostatic pressures present in deep-sea environments.
Barophiles, also known as piezophiles, are microorganisms that require or tolerate extreme hydrostatic pressure for survival and reproduction. This adaptation is a direct evolutionary response to the intense pressure conditions characteristic of deep-sea marine habitats. Their cell membranes and enzymes are structurally modified to function efficiently under pressures that would typically denature proteins in terrestrial organisms.

30. (C) Barophiles - Cured and dried hams
Extreme food environments select for specific microbial groups. Osmophiles spoil high-sugar jams, acidophiles tolerate acidic citrus juices, and halotolerant organisms grow in salted soy sauce. However, cured and dried hams are characterized by low water activity and high salinity rather than high hydrostatic pressure. Therefore, they harbor halotolerant bacteria or molds, while barophiles require deep-ocean hydrostatic pressures.

31. (D) Piezophiles
Seafood harvested from the extreme depths of the ocean is the natural habitat for piezophiles, which are also referred to as barophiles. These specialized microorganisms are structurally adapted to function under the immense hydrostatic pressures and cold temperatures of the deep sea. Their unique cell membranes remain fluid and functional under conditions that inhibit terrestrial microbes.

32. (A) 2 and 3
Halotolerant pathogens do not require sodium chloride for survival, but they can grow in environments with elevated salt levels. Staphylococcus aureus is a notable halotolerant pathogen that can multiply and produce toxins in cured meats. Additionally, many Vibrio species exhibit halotolerance or require sodium for growth, making them key public health concerns in salted or raw seafood.

33. (B) Acidophiles can survive and grow in extreme low pH foods like fruit juices and fermented products.
Acidophiles and alkalophiles are adapted to grow under extreme pH conditions. Acidophiles are capable of surviving and multiplying in low pH environments, such as fermented foods and citrus juices, which typically inhibit other bacteria. Alkalophiles, on the other hand, thrive at high pH levels above nine and are not a major safety concern in acidic food matrices.

34. (A) Both A and R are true and R is the correct explanation of A.
Staphylococcus aureus represents a significant biological hazard in cured and salted meats such as ham and bacon. This pathogen is highly halotolerant and can actively multiply in environments where water activity is lowered by high salt concentrations. Because it outcompetes normal spoilage flora in these conditions, temperature abuse can lead to rapid toxin production.

35. (A) Vibrio parahaemolyticus
Vibrio parahaemolyticus is a moderately halophilic, Gram-negative, rod-shaped bacterium naturally occurring in estuarine and marine environments. This pathogen requires sodium chloride for growth and is commonly associated with outbreaks linked to the consumption of raw or undercooked shellfish, such as oysters. It causes gastroenteritis characterized by diarrhea, abdominal cramps, and vomiting in affected individuals.

Click Here to Buy book on Amazon

cooking temperature, are defined. Monitoring procedures are then established, followed by the determination of corrective actions to execute if a limit is breached.

55. (B) Time required at a specific temperature to achieve a 90% or 1-log reduction of a target microbial population
The D-value is a fundamental parameter in thermal processing, representing the heating time required at a specific temperature to reduce a target microbial population by ninety percent, or one decimal log. In contrast, the Z-value refers to the temperature change needed to alter the D-value by tenfold, and the F-value represents the total equivalent heating time.

56. (C) Predictive models completely replace the need for traditional end-product microbiological testing.
Predictive microbiology models use mathematical equations to describe microbial behavior under various environmental conditions. Primary models track changes over time, secondary models describe parameter shifts, and tertiary models integrate these into software. Although highly useful for estimating shelf life and safety, these mathematical models do not completely replace the need for traditional physical testing and validation.

57. (D) This range is the optimal growth temperature for most rapid-multiplying mesophilic pathogens and spore-formers.
During the cooling of cooked foods, passing quickly through the temperature range between sixty and twenty degrees Celsius is critical. This specific range corresponds to the optimal growth temperatures for most rapid-multiplying mesophilic pathogens and spore-forming bacteria. Slower cooling within this window allows surviving bacterial spores to germinate and multiply exponentially, posing a severe food safety hazard.

58. (A) The uninterrupted handling, storage, and transport of products within a specified low-temperature range.
Cold chain integrity is defined as the continuous, uninterrupted storage and distribution of temperature-sensitive foods within a specified low-temperature range. Maintaining this temperature control from post-harvest processing to retail display is essential for slowing microbial growth and enzymatic activity, thereby ensuring the microbiological safety, quality, and shelf life of refrigerated and frozen products.

59. (B) Surviving spores can germinate, and the resulting vegetative cells will rapidly multiply and potentially produce toxins.
Storing cooked foods under temperature abuse at forty degrees Celsius has a direct effect on spore-forming pathogens. The warm temperature triggers the germination of surviving bacterial spores, such as those of Bacillus cereus or Clostridium perfringens. The resulting vegetative cells multiply rapidly in the warm food matrix and can subsequently produce harmful toxins, leading to food poisoning.

60. (B) Time-Temperature Indicator - Destroys pathogens during transport
Temperature-related concepts must be matched correctly with their functions. The danger zone refers to temperatures between five and sixty degrees Celsius, HACCP provides a systematic approach to hazard prevention, and continuous logging validates cold chain integrity. However, Time-Temperature Indicators do not destroy pathogens; they are passive labels that visually record cumulative heat exposure during transport.

61. (A) Extracellular lipases and proteases that remain active at low temperatures.
Pseudomonas species are highly successful spoilers of refrigerated foods due to specific structural and physiological adaptations. These Gram-negative, aerobic bacteria synthesize extracellular lipases and proteases that remain catalytically active at low temperatures. These enzymes actively hydrolyze food lipids and proteins at four degrees Celsius, producing off-odors, bitter flavors, slime, and rapid quality loss.

62. (A) 1, 3, and 4
Listeria monocytogenes is a foodborne pathogen of major concern in refrigerated ready-to-eat foods. As a psychrotroph, it is capable of active multiplication at temperatures as low as zero to four degrees Celsius. Rather than causing typical gaseous spoilage or container swelling, Listeria poses a severe safety hazard, potentially causing listeriosis in susceptible individuals who consume contaminated products.

NODIA

or one-log reduction in a specific microbial population at a constant temperature. Predictive microbiology uses mathematical models to estimate growth, the cold chain ensures continuous refrigeration, and temperature abuse occurs when safe limits are breached.

46. (C) 60°C
The upper limit of the standard food safety danger zone is sixty degrees Celsius. Above this temperature, the physical heat begins to destabilize bacterial cell membranes and denature essential enzymes, halting rapid multiplication. Consequently, holding cooked foods above this critical temperature ensures that vegetative mesophilic pathogens cannot grow, thereby maintaining the safety of the food.

47. (A) 1, 3, and 4
Predictive microbiology models use mathematical equations to forecast microbial behavior in food systems. These models are built using key parameters such as temperature, pH, and water activity to estimate growth, survival, or inactivation over time. They are valuable tools for determining safe shelf life, though they supplement rather than replace physical temperature monitoring and validation.

48. (C) They provide a verified record of temperature conditions to ensure HACCP critical limits have not been breached.
Temperature monitoring systems in food transport serve to continuously document environmental conditions. By providing a verified, uninterrupted record of temperature exposure, these systems allow food safety managers to confirm that critical limits within the HACCP plan were maintained. This documentation is essential for validating cold chain integrity and ensuring that the food remained safe during transit.

49. (A) Both A and R are true and R is the correct explanation of A.
Thermal processing schedules for low-acid canned foods are designed based on the extreme heat resistance of bacterial endspores. Spores of Clostridium botulinum can survive simple boiling water temperatures and require pressurized steam cooking, typically at one hundred and twenty-one degrees Celsius, for complete destruction. This high-temperature treatment is necessary to prevent germination and toxin production.

50. (D) The precise temperature profile of the storage and distribution chain.
To generate accurate predictions using predictive microbiology models, a food facility must input precise environmental data. Because microbial growth rates are highly sensitive to thermal conditions, obtaining the exact temperature profile of the storage and distribution chain is essential. This temperature history directly dictates the lag phase and growth kinetics of target organisms like Listeria monocytogenes.

51. (A) P-II, Q-IV, R-I, S-III
Implementing a HACCP plan involves aligning specific components with practical processing steps. The cooking stage represents a Critical Control Point. Achieving an internal temperature of seventy-four degrees Celsius serves as the Critical Limit. Checking this temperature using a calibrated thermometer represents the Monitoring Procedure, and discarding undercooked poultry represents the necessary Corrective Action.

52. (C) Immediate destruction of heat-resistant thermophilic spores.
A break in cold chain integrity leads to several negative consequences for refrigerated foods, including accelerated growth of psychrotrophic spoilers and potential outgrowth of mesophilic pathogens. These factors combine to significantly reduce product shelf life. However, elevated temperatures from a cold chain failure do not destroy thermophilic spores, which require severe thermal processing for inactivation.

53. (A) Both Statement I and Statement II are correct.
Modern food storage systems utilize advanced temperature monitoring devices, including digital data loggers and smart Time-Temperature Indicators. These indicators are attached directly to food packaging, where they undergo a gradual, irreversible chemical or physical color change. This visual shift reflects the cumulative time-temperature history of the product, indicating whether temperature abuse occurred during distribution.

54. (A) 3, 1, 4, 2
Establishing a temperature-based Critical Control Point in a HACCP plan follows a logical, sequential process. First, the specific heating or cooling step is identified as a critical control point. Next, critical limits, such as a minimum

Downloaded from www.pdf.tube

above twenty degrees Celsius. They can grow at refrigeration temperatures, allowing them to cause extensive spoilage in pasteurized milk and chilled meats despite their warm preferences.

72. (C) The model must rely on equations detailing optimal growth at 37°C adjusted downwards, accounting for its psychrotrophic nature.
To formulate a predictive microbiology model for Listeria monocytogenes in sliced turkey stored at four degrees Celsius, modelers must account for its psychrotrophic nature. The model relies on equations that describe its growth kinetics, adjusting optimal growth parameters downwards to reflect slow but steady replication under refrigerated conditions, ensuring an accurate prediction of shelf life and safety.

73. (D) An organism capable of active growth at refrigeration temperatures between 0°C and 7°C but possessing an optimum growth temperature above 20°C.
A psychrotroph is defined as an organism capable of multiplying at refrigeration temperatures, typically between zero and seven degrees Celsius, while possessing an optimum growth temperature above twenty degrees Celsius. This adaptation allows these cold-tolerant mesophiles to colonize and spoil chilled foods, presenting a significant challenge to the cold-storage preservation of perishable commodities.

74. (A) It causes physical cell damage to the food matrix and allows psychrotrophs to multiply during the thawed phase, reducing shelf life.
Temperature fluctuations that cause freeze-thaw cycles in frozen vegetables have a direct negative impact. The physical thawing process damages plant cell walls, releasing intracellular nutrients. This nutrient-rich environment allows psychrotrophic microorganisms to multiply during the thawed phase. Subsequent refreezing does not undo this bacterial growth, leading to accelerated spoilage and reduced product shelf life.

75. (B) Staphylococcus aureus - True psychrophile
Organisms must be classified correctly based on their temperature preferences. Pseudomonas fragi is a psychrotrophic spoiler, Listeria monocytogenes is a psychrotrophic pathogen, and Salmonella enterica is a mesophilic pathogen. However, Staphylococcus aureus is a mesophile with an optimal growth temperature near thirty-seven degrees Celsius; it is not a true psychrophile and cannot grow at cold temperatures.

76. (B) Mesophiles
Microorganisms whose optimal growth temperature closely aligns with human body temperature are classified as mesophiles. These organisms thrive in moderate temperature ranges, typically between twenty and forty-five degrees Celsius. Because of this physiological alignment, almost all human pathogens are mesophilic, allowing them to colonize host tissues and cause infections or produce toxins under ambient conditions.

77. (A) 1, 2, and 3
Mesophilic microorganisms grow optimally between twenty and forty-five degrees Celsius and include major foodborne pathogens like Escherichia coli and Salmonella enterica. While lowering the temperature to four degrees Celsius halts their rapid multiplication, refrigeration does not completely eradicate these bacteria. Instead, they remain dormant and can resume growth if the temperature rises into the danger zone.

NODIA

78. (C) Because the vast majority of foodborne pathogens are mesophiles, strict temperature control (hot holding or cold holding) is essential to prevent their rapid multiplication.
The food safety relevance of mesophiles stems from the fact that most foodborne pathogens belong to this group. Because these organisms multiply rapidly at ambient temperatures, maintaining strict temperature controls is critical. Keeping foods cold below five degrees Celsius or hot above sixty degrees Celsius prevents these pathogens from growing to infectious or toxin-producing levels.

79. (A) Both A and R are true and R is the correct explanation of A.
Leaving perishable foods at room temperature for several hours significantly increases the risk of foodborne illness. This occurs because typical room temperatures fall directly within the optimal growth range for mesophilic pathogens. Under these favorable thermal conditions, bacteria can multiply exponentially, quickly reaching levels that can cause infection or lead to the production of harmful toxins.

63. (D) Increased proportions of unsaturated fatty acids in the cell membrane lipid bilayer to maintain homeoviscous fluidity.
A key physiological adaptation of psychrotrophic microorganisms to cold temperatures involves adjusting cell membrane composition. These organisms increase the proportion of unsaturated fatty acids within their lipid bilayer at low temperatures. This alteration prevents the cell membrane from freezing or becoming rigid, thereby maintaining homeoviscous fluidity and ensuring the continuous transport of nutrients into the cell.

64. (A) Both A and R are true and R is the correct explanation of A.
Ready-to-eat deli meats present a major risk for foodborne listeriosis when subjected to prolonged refrigerated storage. This risk arises because Listeria monocytogenes is a psychrotrophic pathogen that can actively replicate at cold temperatures. Over time, it can outgrow background microflora in unheated refrigerated foods, reaching infectious levels that pose a severe threat to public health.

65. (B) Pseudomonas
Refrigerated pasteurized milk that develops a ropy texture and fruity off-flavor after storage is typically spoiled by Pseudomonas species. This genus consists of Gram-negative, strictly aerobic, highly motile, psychrotrophic bacilli. These bacteria produce extracellular enzymes that actively degrade milk components at refrigeration temperatures, leading to characteristic spoilage defects in fluid dairy products.

66. (A) P-I, Q-II, R-IV, S-III
Microorganisms exhibit specific physiological features and spoilage roles in chilled foods. Pseudomonas fluorescens causes off-flavors and surface slime on refrigerated meats. Listeria monocytogenes is a key psychrotrophic pathogen in unpasteurized cheeses. Psychrotrophs maintain membrane fluidity in the cold by increasing unsaturated fatty acids. Finally, proteolytic spoilage involves the bacterial breakdown of proteins, causing bitterness in milk.

67. (A) Increased synthesis of highly saturated lipids in the cell membrane.
Cold-adapted psychrophilic and psychrotrophic bacteria possess several specialized physiological mechanisms, including the production of cold-shock proteins and high-efficiency cold-active enzymes. To maintain cell membrane fluidity at low temperatures, these organisms increase the proportion of unsaturated fatty acids. They do not increase saturated lipids, as saturated fats would solidify and disrupt membrane function under cold conditions.

68. (D) Statement I is incorrect but Statement II is correct.
True psychrophiles require cold temperatures and are rarely the primary cause of spoilage in standard household refrigerators. Instead, psychrotrophs dominate this niche. Psychrotrophs possess mesophilic optimal temperatures but can multiply efficiently at low temperatures, allowing them to outcompete true psychrophiles in food storage. They also survive brief periods of warming, making them highly effective spoilers.

69. (A) 3, 5, 1, 4, 2
Microorganisms can be ordered systematically based on their optimal growth temperatures. True psychrophiles have the lowest optimal range, followed by psychrotrophs, which grow at cold temperatures but prefer moderate warmth. Mesophiles occupy the middle range, while thermophiles require elevated heat. Hyperthermophiles possess the highest optimal temperatures, exceeding eighty degrees Celsius. This sequence represents progressive temperature adaptation.

70. (D) Listeria monocytogenes - Psychrotrophic pathogen
Temperature-based microbial classifications must be paired correctly with representative organisms. Listeria monocytogenes is a well-known psychrotrophic pathogen capable of multiplying at refrigeration temperatures. Conversely, Pseudomonas species are psychrotrophic spoilers rather than strict thermophiles, psychrophiles grow optimally below fifteen degrees Celsius rather than thirty-seven, and thermophiles require temperatures above fifty-five degrees Celsius.

71. (B) They are synonymous with psychrophiles in their absolute requirement for extremely cold temperatures.
Psychrotrophs are distinct from true psychrophiles and are not synonymous with them. While psychrophiles require cold temperatures for survival, psychrotrophs are cold-tolerant mesophiles with an optimal growth temperature

Click Here to Buy book on Amazon

mesophilic spore germination and rapid bacterial multiplication.
Inadequately cooling a cooked stew and then gently reheating it to forty-five degrees Celsius creates a severe food safety hazard. This temperature profile allows surviving mesophilic bacterial spores to germinate. The mild reheating temperature falls within their optimal growth range, promoting rapid bacterial multiplication and potential toxin production, which increases the risk of foodborne poisoning.

90. (A) Thermophile germination - Triggered consistently at 4°C
Microbial activities are closely linked to specific temperature ranges. Mesophilic toxin production is optimal around body temperature, psychrotrophic multiplication occurs slowly under refrigeration, and hyperthermophilic growth occurs above eighty degrees Celsius. However, thermophile germination is not triggered at four degrees Celsius, as thermophilic spores require elevated temperatures to germinate and initiate metabolic activity.

91. (B) Desulfotomaculum nigrificans
Sulphide stinker spoilage in canned foods is classically caused by Desulfotomaculum nigrificans, a thermophilic, spore-forming, anaerobic bacterium. This organism reduces sulfur-containing compounds in the food, producing hydrogen sulfide gas. The gas reacts with the metal of the can to form iron sulfide, resulting in a blackened appearance and a characteristic rotten-egg odor in the product.

92. (A) 1, 2, and 4
Flat sour spoilage in canned foods is caused by thermophilic spore-formers such as Geobacillus stearothermophilus. These organisms ferment sugars to produce high levels of lactic acid, significantly lowering the pH of the food. Because this fermentation process does not generate carbon dioxide or hydrogen gas, the can ends remain flat, showing no visible signs of swelling.

93. (A) Because their spores are highly heat-resistant, thermal processing schedules for low-acid foods must be designed to either destroy them or store the cans below their germination temperature.
Thermophiles are highly relevant in the canning industry due to the extreme heat resistance of their spores. Thermal processing schedules for low-acid canned foods must be designed to destroy these spores or, alternatively, processed cans must be cooled and stored below forty-five degrees Celsius to prevent surviving spores from germinating and causing flat sour spoilage.

94. (A) Both A and R are true and R is the correct explanation of A.
Rapidly cooling canned foods to below forty degrees Celsius immediately after retort processing is a critical control measure. This rapid cooling prevents the germination of surviving thermophilic spores, which require temperatures above forty-five degrees Celsius to grow. If cans are allowed to remain warm, these heat-resistant spores will germinate and cause rapid product spoilage during storage.

95. (D) Flat sour spoilage due to thermophilic spore germination during extended warm storage.
Stacking warm, retort-processed cans on pallets without forced-air cooling causes the center of the stack to retain heat for an extended period. This prolonged warm storage creates ideal conditions for the germination of surviving thermophilic spores. The resulting vegetative cells undergo fermentation, producing acid without gas, which leads to flat sour spoilage in the product.

96. (A) P-II, Q-III, R-I, S-IV
Different thermophilic organisms cause specific defects in canned foods. Geobacillus stearothermophilus causes flat sour spoilage, producing acid without gas. Clostridium thermosaccharolyticum causes thermophilic anaerobic spoilage, producing acid and massive gas. Desulfotomaculum nigrificans causes sulphide stinker spoilage, leading to blackening and hydrogen sulfide odor. Finally, Thermoanaerobacterium aethylicum produces hydrogen and ethanol during growth.

97. (B) Flat sour spoilage
Can swelling, such as a hard swell, is caused by gas accumulation inside the container. This gas can result from the growth of putrefactive anaerobes or Clostridium thermosaccharolyticum, or from chemical corrosion producing hydrogen. In contrast, flat sour spoilage is characterized by acid production without gas, meaning the can ends remain flat and do not swell.

Downloaded from www.pdf.tube

116. (C) They are highly susceptible to spoilage by halophiles in high-acid conditions.
Acidophiles are adapted to grow in low pH environments like fruit juices and fermented foods. Alicyclobacillus acidoterrestris is a spore-forming acidophile that causes spoilage in pasteurized juices, and many lactic acid bacteria are acid-tolerant. However, acidophiles are not highly susceptible to spoilage by halophiles, as halophiles require high salt concentrations rather than acidic conditions to grow.

117. (A) Low pH reduces the D-value of bacterial spores, allowing for milder thermal processing (e.g., a boiling water bath).
An acidic environment interacts directly with the heat resistance of microorganisms. High acidity destabilizes bacterial structures, reducing the D-value of bacterial spores during heating. This reduction in heat resistance allows food processors to use milder thermal treatments, such as a boiling water bath, to achieve commercial sterility in high-acid foods compared to low-acid canned foods.

118. (D) An organism adapted to survive in environments with high osmotic pressures, typically due to elevated sugar concentrations.
An osmophile is defined as an organism adapted to survive and grow in environments with high osmotic pressure, which is typically caused by elevated sugar concentrations. These organisms, predominantly specialized yeasts, employ physiological mechanisms to balance internal and external osmotic forces, allowing them to cause spoilage in sweet foods like syrups, honey, and confectionery fillings.

119. (B) The hypertonic environment causes water to exit the cell via osmosis (cause), leading to plasmolysis and growth inhibition (effect).
Placing a typical mesophilic, non-halotolerant bacterial cell into a twenty percent sodium chloride brine creates a highly hypertonic environment. This osmotic gradient causes intracellular water to exit the cell rapidly (cause). This loss of water leads to plasmolysis, cell shrinkage, and the inhibition of metabolic activity and growth, which is a fundamental mechanism of food preservation.

120. (C) High temperatures - Enzymes with highly flexible, easily denatured structures
Microorganisms employ specific physiological adaptations to survive extreme environments. Low water activity prompts compatible solute accumulation, cold environments require membrane unsaturated fatty acids, and high pressure requires modified porins. However, high-temperature survival requires enzymes with rigid, highly stable structures stabilized by extra salt bridges and hydrogen bonds, rather than flexible, easily denatured protein configurations.

121. (D) 5°C
The lower limit of the temperature danger zone in food safety regulations is five degrees Celsius. Below this critical temperature, the metabolic activity of most mesophilic foodborne pathogens slows down significantly, preventing rapid multiplication. Maintaining refrigerated storage at or below this temperature is essential for inhibiting pathogen growth and ensuring the safety of perishable foods.

NODIA

122. (A) 1, 2, and 4
Primary predictive microbiology models describe changes in microbial numbers over time under constant environmental conditions. These mathematical models rely on key parameters, including the lag phase duration, the specific maximum growth rate, and the maximum population density of the target organism. Physical characteristics of the packaging, such as its color, are not variables in these primary biological models.

123. (B) Continuous automated temperature monitoring and data logging are critical for verifying that food has not entered the danger zone during transport.
Temperature monitoring in the cold chain is essential for verifying food safety. Continuous automated systems and digital data loggers provide an uninterrupted record of temperature exposure during transport. This documentation is critical for confirming that perishable food did not enter the danger zone, where pathogens could multiply, thereby validating the microbiological safety of the shipment.

124. (D) A is false but R is true.
Freezing food to minus eighteen degrees Celsius halts microbial growth but does not reliably kill all foodborne pathogens. While ice crystal formation can physically damage and rupture some cell membranes, many bacterial cells survive the freezing process in a dormant state. Upon thawing, these surviving pathogens can resume

mechanisms to maintain cellular hydration under osmotic stress, preventing cellular collapse.

107. (C) 1, 2, and 3
Halophilic and halotolerant microorganisms exhibit distinct physiological adaptations. True halophiles require sodium chloride for cellular stability and growth, while halotolerant organisms do not require salt but can tolerate high-salinity conditions. Staphylococcus aureus is a classic halotolerant pathogen. Halophiles are not destroyed by lowering water activity with salt; instead, they are stimulated by these conditions.

108. (B) They are specialized microorganisms, often yeasts, that thrive and multiply in environments with high sugar concentrations.
Osmophiles are specialized microorganisms, primarily yeasts, that possess the unique ability to survive and multiply in environments with high sugar concentrations. These high-solute matrices exert extreme osmotic pressure, which inhibits conventional bacteria. Osmophiles adapt by accumulating compatible solutes, such as polyols, allowing them to ferment sugars and cause spoilage in products like syrups and honey.

109. (A) Both A and R are true and R is the correct explanation of A.
Honey rarely spoils from bacterial growth due to its exceptionally low water activity, which is caused by its high sugar concentration. This low moisture availability inhibits the growth of most vegetative bacteria. However, certain osmophilic yeasts can survive and grow in honey under favorable conditions, fermenting the sugars into alcohol and carbon dioxide, leading to product spoilage.

110. (C) Osmophilic yeasts
A fruit jam with a low pH and sixty-five percent sugar content exerts high osmotic pressure, which effectively inhibits the growth of most bacteria. Under these conditions, the development of bubbling and an alcohol-like odor indicates active fermentation. This spoilage is caused by osmophilic yeasts, which are uniquely adapted to grow in high-sugar, acidic environments.

111. (A) P-IV, Q-II, R-III, S-I
Specific food environments select for distinct groups of extremophilic microorganisms. High-salt soy sauce supports the growth of extreme halophiles. Dehydrated milk powder, characterized by low water activity, is colonized by xerophiles. Maple syrup, with its high sugar concentration, is spoiled by osmophiles. Finally, pickled onions represent an acidic environment with low pH, selecting for acidophiles.

112. (C) Campylobacter jejuni
Many microorganisms can tolerate or require salt for growth, including Vibrio parahaemolyticus, Staphylococcus aureus, and Halobacterium species. In contrast, Campylobacter jejuni is highly sensitive to environmental stressors, including low water activity and high osmotic pressure. This pathogen cannot survive or grow in high-salt environments, requiring high water activity and specific microaerophilic conditions instead.

113. (A) Both Statement I and Statement II are correct.
Fungi, including molds and yeasts, are generally more tolerant of low water activity than most bacteria, allowing them to dominate dry niches. Xerophilic molds are particularly adapted to grow on dried grains and cereals. During their growth, these molds can synthesize dangerous secondary metabolites known as mycotoxins, posing a serious chemical safety hazard in stored agricultural commodities.

114. (D) Lowering the water activity (a_w) below 0.85 using sugar and salt to exceed the pathogen's halotolerant/osmotolerant limits.
Reformulating a bakery filling to prevent the growth of Staphylococcus aureus without refrigeration relies on the hurdle concept. By adding sugar and salt, the water activity is lowered below point eight five. This reduction exceeds the halotolerant and osmotolerant limits of the pathogen, preventing it from multiplying or producing enterotoxins, thereby ensuring the safety of the product.

115. (A) Xerophilic molds - a_w 0.61
Extremophilic groups are characterized by their minimum water activity limits. Xerophilic molds are exceptionally tolerant of dry conditions, with some species capable of growing at a water activity as low as point six one. Normal mesophilic bacteria require much higher water activity levels, and extreme halophiles grow down to point seven five, making the xerophile pairing correct.

Click Here to Buy book on Amazon

fermented soy sauce. However, hyperthermophiles are not associated with refrigerated pasteurized milk, as they require temperatures above eighty degrees Celsius to grow and are completely inactive under cold refrigeration conditions.

www.nodia.in

NODIA

metabolic activity and multiply, posing a safety hazard.

125. (A) The minimum internal core temperature and the continuous time the thermal center is maintained at or above that level.
Validating a cooking process to ensure the destruction of vegetative pathogens requires evaluating thermal lethality parameters. The food safety team must measure the minimum internal core temperature achieved and the continuous time that the thermal center is maintained at or above that critical level. This combination of time and temperature determines the overall effectiveness of the thermal process.

126. (A) P-II, Q-III, R-I, S-IV
Predictive microbiology operates at different model levels. Primary models describe microbial numbers changing over time under constant conditions. Secondary models describe how primary parameters, like growth rate, change in response to environmental factors. Tertiary models integrate these equations into user-friendly software. Finally, validation models compare predictions against independent experimental data collected in real food matrices.

127. (D) Allowing the warehouse temperature for canned goods to fluctuate between 30°C and 45°C.
In a HACCP plan, critical limits are established to ensure safety at critical control points. These include cooking poultry to seventy-four degrees Celsius, storing chilled foods below five degrees Celsius, and holding hot foods above sixty degrees Celsius. Allowing warehouse temperatures to fluctuate between thirty and forty-five degrees Celsius is not a critical limit; instead, it represents poor storage practice.

128. (C) Statement I is correct but Statement II is incorrect.
Time-Temperature Indicators are smart labels attached to food packaging that undergo an irreversible chemical or physical change, providing a visual indication of cumulative thermal exposure. However, these indicators are passive devices used for monitoring; they do not possess any cooling mechanism and cannot physically lower the temperature of the product if a temperature rise occurs.

129. (B) Utilizing digital temperature data loggers and smart Time-Temperature Indicators (TTIs) on the pallets.
To detect temperature abuse during the transport of fresh fish, using digital temperature data loggers and smart Time-Temperature Indicators is the most effective approach. These devices continuously record environmental conditions and provide a visual, cumulative history of thermal exposure. This allows receivers to immediately identify if the cold chain was breached, ensuring product safety.

130. (D) Thermocouple - Rapid response internal temperature measurement
Temperature monitoring devices must be matched correctly with their applications. A thermocouple is a highly accurate sensor that provides rapid-response internal temperature measurements, making it ideal for monitoring thermal processing. Other devices, like infrared thermometers, only measure surface temperatures, and Time-Temperature Indicators record cumulative thermal exposure rather than validating sterilization temperatures inside pressurized retort vessels.

131. (A) A breakdown in the cold chain is usually reversible by simply freezing the product afterwards.
Cold chain logistics are designed to maintain the quality and safety of temperature-sensitive foods. However, a breakdown in the cold chain is not reversible by freezing the product afterward. If pathogens grow or produce heat-stable toxins during a temperature breach, subsequent freezing will only halt growth but will not eliminate pre-formed toxins or destroy viable pathogens.

132. (C) At 15°C, the lag phase will be significantly longer, and the slope of the exponential phase (growth rate) will be less steep than at 37°C.
In a predictive microbiology growth curve, lowering the storage temperature of a mesophile from thirty-seven to fifteen degrees Celsius significantly alters its growth kinetics. At the lower temperature, the lag phase is extended because metabolic activity slows down. Additionally, the slope of the exponential phase, which represents the growth rate, becomes much less steep.

Downloaded from www.pdf.tube

(A) It shears the wheat bran layers into very small and manageable flakes.
(B) It separates the wheat germ from the endosperm while keeping it intact.
(C) It rapidly decreases the moisture level of the final milled product.
(D) It crushes middlings into fine flour without pulverizing the bran.

9. Given below are two statements:
Statement I: Purifiers in a wheat mill use a combination of oscillating sieves and air currents.
Statement II: Purifiers separate endosperm particles (middlings) from bran particles based on specific gravity and particle size.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

10. Arrange the following fundamental steps of wheat milling in the correct sequential order:
1. Reduction
2. Cleaning
3. Tempering
4. Breaking
5. Purifying

(A) 2, 3, 4, 5, 1
(B) 2, 4, 3, 1, 5
(C) (3) 3, 2, 4, 5, 1
(D) 2, 3, 5, 4, 1

11. Which wheat parameter should be high in the flour chosen for making hard, crusty bread?
(A) Starch damage percentage
(B) Ash content
(C) Carotenoid pigmentation
(D) Glutenin and gliadin content

12. Identify the incorrect statement concerning wheat by-products.
(A) Wheat pollard is primarily used as a premium human food supplement.
(B) Wheat bran is rich in dietary fiber and minerals.
(C) Wheat germ has poor keeping quality due to its high oil content.
(D) The aleurone layer is largely removed along with the bran during milling.

13. During grain storage in a silo, a sharp increase in grain temperature and CO_2 levels indicates which of the following scenarios?
(A) Normal cellular respiration of completely dry and dormant grain
(B) Onset of insect infestation and fungal growth in moist grain
(C) Effective chemical fumigation gas action taking place inside
(D) The stored grain reaching its natural equilibrium moisture level

NODIA

14. Identify the correct pair of milling machinery and its function.
(A) Plansifter – Grinding down very coarse wheat particles into fine flour
(B) Scourer – Removing outer surface dirt and the beard of wheat kernels
(C) Destoner – Sorting wheat grains based on color and optical differences
(D) Magnetic separator – Removing light field impurities like dust and chaff

15. How can a sample of refined wheat flour (Maida) be evaluated for excessive bran contamination?
(A) By measuring the ash content of the flour
(B) By testing the flour's water absorption capacity
(C) By determining the gluten index
(D) By performing an iodine test for starch

16. Match the stages of rice processing in List I with their descriptions in List II.
List I: (Stages of rice processing)
P. Hulling
Q. Milling/Polishing
R. Parboiling
S. Grading
List II: (Descriptions)
I. Hydrothermal treatment of paddy
II. Removal of the outer husk
III. Sorting based on size and broken percentage
IV. Removal of the bran layer
(A) P-II, Q-IV, R-I, S-III
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-I, R-III, S-IV
(D) P-IV, Q-II, R-I, S-III

17. Which essential nutrient migrates from the bran to the endosperm during the parboiling of rice?
(A) Vitamin C
(B) Vitamin D
(C) Calcium
(D) Vitamin B1 (Thiamine)

osmophilic organisms thrive in high-solute environments with high sugar concentrations, such as syrups and honey.

142. (C) Decreased solubility of polymeric substrates at high temperatures.
Using extremozymes from hyperthermophiles in food biotechnology offers several advantages, including resistance to thermal denaturation and faster reaction rates at elevated temperatures. However, operating at high temperatures increases rather than decreases the solubility of polymeric substrates like starch. Therefore, decreased solubility is not an advantage or characteristic of using these thermostable enzymes in processing.

143. (A) Both Statement I and Statement II are correct.
The discovery of Taq polymerase, a heat-stable DNA polymerase isolated from a hyperthermophilic bacterium, revolutionized molecular biology by enabling the polymerase chain reaction. Similarly, other heat-stable enzymes derived from thermophilic and hyperthermophilic sources are widely used in the food industry to hydrolyze starch and process complex carbohydrates efficiently at elevated temperatures.

144. (C) Listeria slowly grew during the 4°C phase (psychrotrophic), while S. aureus multiplied and produced toxin at 30°C (mesophilic).
The mixed temperature abuse of pasta salad demonstrates the distinct growth characteristics of different pathogens. During the initial three-day refrigerated storage at four degrees Celsius, the psychrotrophic pathogen Listeria monocytogenes slowly multiplied. Subsequently, when the food was left at thirty degrees Celsius, the mesophilic pathogen Staphylococcus aureus grew rapidly and produced its heat-stable enterotoxin.

145. (B) Psychrophiles: <15°C | Mesophiles: 20-45°C | Thermophiles: 50-70°C
Microorganisms are categorized into distinct groups based on their optimal growth temperature ranges. Psychrophiles are cold-loving organisms that grow optimally at fifteen degrees Celsius or lower. Mesophiles, including most foodborne pathogens, grow best at moderate temperatures between twenty and forty-five degrees Celsius. Thermophiles prefer elevated temperatures, displaying an optimal growth range between fifty and seventy degrees Celsius.

146. (D) They are identical to xerophiles in their fundamental physiological adaptations.
Piezophiles, which are synonymous with barophiles, are adapted to function under extreme hydrostatic pressure by modifying their cell membranes and enzymes. They are relevant to the microbiology of deep-sea seafood. However, piezophiles are not identical to xerophiles, as xerophiles are adapted to survive low water activity, whereas piezophiles require high pressure in aqueous environments.

147. (A) Barophiles (Piezophiles)
High Pressure Processing is a non-thermal preservation technique that uses extreme hydrostatic pressure to inactivate foodborne pathogens and spoilage organisms. Because this process targets cellular structures sensitive to pressure, barophiles or piezophiles possess the greatest innate resistance to this method. These specialized organisms are structurally adapted to survive and function under intense hydrostatic pressure conditions.

148. (C) An organism that optimally grows at a pH above 9.0.
An alkalophile is defined as an organism that grows optimally in highly basic environments, typically at a pH above nine point zero. These specialized microorganisms possess unique physiological adaptations, such as modified cell walls and membrane transport systems, that allow them to maintain a neutral internal pH while thriving in alkaline food environments or soils.

149. (A) Increased numbers of internal hydrogen bonds and salt bridges (cause) result in extreme thermal stability of their enzymes (effect).
Hyperthermophilic proteins possess unique structural adaptations that prevent denaturation at high temperatures. An increased number of internal hydrogen bonds, hydrophobic interactions, and ionic salt bridges (cause) stabilize the folded protein structure. This structural reinforcement results in the extreme thermal stability of their enzymes (effect), allowing them to remain functional near the boiling point of water.

150. (D) Hyperthermophiles - Refrigerated pasteurized milk
Microbial groups must be paired correctly with their typical food vehicles. Psychrotrophs grow in chilled ready-to-eat meals, thermophiles spoil low-acid canned foods, and halophiles thrive in

Click Here to Buy book on Amazon

133. (A) Keeping TCS foods in the danger zone long enough to allow pathogen multiplication or toxin production.
Time-temperature abuse in food safety refers to keeping time/temperature control for safety foods within the danger zone. Leaving food between five and sixty degrees Celsius for an extended period allows vegetative pathogens to multiply to infectious levels or produce harmful toxins. Preventing this abuse through strict temperature control is critical for reducing the risk of foodborne illness.

134. (D) The prolonged cooling time (cause) allows surviving spores to germinate and vegetative cells to rapidly multiply (effect).
Cooling a large stockpot of chili slowly over twelve hours represents severe temperature abuse. This prolonged cooling period (cause) allows the food to spend excessive time within the danger zone. Consequently, surviving bacterial spores, such as those of Clostridium perfringens, germinate, and the resulting vegetative cells multiply rapidly in the nutrient-rich matrix (effect).

135. (B) Survival model - Designing the packaging color to maximize consumer appeal.
Predictive microbiology models serve specific scientific functions in food safety. Growth models estimate the replication of pathogens, inactivation models predict thermal destruction during processing, and probability models estimate the likelihood of spore germination. However, survival models do not involve aesthetic packaging design, as marketing decisions are unrelated to mathematical equations describing microbial survival under environmental stress.

136. (C) Extremely high hydrostatic pressure.
Barophiles, which are also classified as piezophiles, are characterized by their strict environmental requirement for extremely high hydrostatic pressure to survive and replicate. These specialized microorganisms are typically found in deep-sea habitats, such as the ocean floor, where they have adapted to function under pressures that would otherwise denature the proteins and cell membranes of terrestrial organisms.

137. (A) 1, 2, and 4
Enzymes from hyperthermophiles, known as extremozymes, exhibit high stability under extreme processing conditions. They are utilized in starch hydrolysis because they remain active at elevated temperatures, which reduces viscosity and facilitates processing. Furthermore, operating at high temperatures minimizes the risk of mesophilic contamination, though these specialized enzymes do not function optimally below thirty degrees Celsius.

138. (A) They are primarily isolated from deep-sea habitats and are a consideration in deep-sea seafood products.
Barophiles are specialized microorganisms adapted to thrive under extreme hydrostatic pressures. These organisms are primarily isolated from deep-sea marine habitats and are a consideration in seafood harvested from extreme depths. They do not grow on dried foods or cause spoilage in standard canned goods stored at ambient room temperatures, which lack extreme hydrostatic pressure.

139. (A) Both A and R are true and R is the correct explanation of A.
Deep-sea fish products can harbor unique spoilage organisms that are adapted to high pressure and cold temperatures. This occurs because the deep ocean environment is characterized by intense hydrostatic pressure and low temperatures, typically around two to three degrees Celsius. These conditions select for psychrophilic piezophiles, which can carry out metabolic activities in deep-sea seafood.

140. (B) Hyperthermophiles
To develop enzymes for an industrial fruit juice clarification process operating at an elevated temperature of eighty-five degrees Celsius, researchers should source them from hyperthermophiles. These extreme organisms produce specialized enzymes, known as extremozymes, that possess remarkable thermal stability. These enzymes resist denaturation and remain catalytically active at temperatures that would quickly destroy standard mesophilic or psychrotrophic proteins.

141. (A) P-I, Q-II, R-III, S-IV
Microorganisms are classified based on their physiological adaptations and industrial relevance. Thermoduric organisms survive pasteurization temperatures without necessarily growing. Psychrotrophic organisms grow under refrigeration but have mesophilic optima. Piezophilic or barophilic organisms depend on or tolerate extreme hydrostatic pressure. Finally,

NODIA

CHAPTER 14
Processing of Plant-Based Foods

1. Match the post-harvest operations in List I with their primary functions in List II.
List I: (Post-harvest operations)
P. Threshing
Q. Winnowing
R. Curing
S. Drying
List II: (Primary functions)
I. Separation of chaff from grain using air flow
II. Detachment of grain from the panicle
III. Reduction of moisture content for safe storage
IV. Toughening of outer skin to reduce water loss
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-I, R-IV, S-III
(C) P-II, Q-I, R-III, S-IV
(D) P-III, Q-IV, R-I, S-II

2. What is the standard extraction rate of whole wheat flour (atta) in traditional Indian milling?
(A) 70-75%
(B) 80-85%
(C) 90-95%
(D) 100%

3. Identify the correct statement regarding the conditioning of wheat before milling.
(A) Conditioning removes outer surface dust and microbial impurities from the wheat kernel.
(B) Conditioning involves adding water to toughen the bran and mellow the endosperm.
(C) Conditioning decreases the moisture content of the wheat to halt microbial spoilage.
(D) Conditioning eliminates the main active anti-nutritional compounds in wheat germ.

4. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Tempering of wheat prior to milling increases the yield of high-quality white flour.
Reason (R): Tempering makes the bran brittle, allowing it to easily shatter into fine powder during the break system.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

5. Identify the incorrect pair regarding wheat milling products and their typical uses.
(A) Clear flour – Premium white sandwich bread
(B) Straight grade flour – General purpose baking
(C) Patent flour – High-quality baked goods like cakes
(D) Semolina (Suji) – Pasta and extruded products

6. In flour milling, how is "extraction rate" defined?
(A) The total percentage of bran and germ removed from the wheat kernel.
(B) The yield percentage of wheat germ extracted for industrial oil extraction.
(C) The percentage of whole grain converted into the final flour product.
(D) The exact percentage of moisture added to wheat during tempering steps.

NODIA

Consider the following statements regarding the break system in wheat milling:
I. It utilizes pairs of corrugated rolls rotating at different speeds.
II. Its primary purpose is to reduce endosperm chunks into fine flour.
III. It scrapes the endosperm away from the bran.
IV. The clearance between the rolls decreases with each successive break stage.
Which of the above statements are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

8. What is the direct effect of using smooth rolls in the reduction system of a wheat mill?

98. (C) Statement I is correct but Statement II is incorrect.
Clostridium thermosaccharolyticum is a major cause of thermophilic anaerobic spoilage, producing large amounts of gas that cause cans to swell. In contrast, while sulphide stinker spoilage, caused by Desulfotomaculum nigrificans, produces hydrogen sulfide, this gas is soluble and reacts with the metal to form iron sulfide. Consequently, sulphide stinker spoilage does not typically cause swelling.

99. (A) Quarantine the batch due to a high risk of thermophilic spoilage (e.g., flat sour).
Leaving processed canned peas at fifty-five degrees Celsius due to inadequate cooling represents a major processing failure. This temperature falls within the optimal germination and growth range for thermophilic spore-formers. Quarantining the batch is necessary because surviving spores are highly likely to germinate and cause flat sour spoilage, rendering the product unmarketable.

100. (C) Clostridium thermosaccharolyticum - Gaseous swelling and sour organic acid odor
In canned food microbiology, spoilage defects must be matched correctly with their causative agents. Clostridium thermosaccharolyticum is a thermophilic anaerobe that ferments carbohydrates, producing sour organic acids and large volumes of gas that cause container swelling. In contrast, flat sour spoilage produces no gas, and sulphide stinker spoilage results in chemical blackening without swelling.

101. (A) They are widely recognized as frequent human foodborne pathogens.
Hyperthermophiles are extreme heat-loving organisms with optimal growth temperatures exceeding eighty degrees Celsius. They are typically isolated from geothermal environments, and their enzymes are highly valued in food biotechnology for their stability. However, they are not human foodborne pathogens because they cannot multiply at human body temperature or standard room temperatures, presenting no direct infectious risk.

102. (D) Determining the heating time required to achieve a 1-log reduction in population at a specific reference temperature, usually 121.1°C.
In food engineering, calculating the D-value for a thermophilic spore-former like Geobacillus stearothermophilus involves measuring its thermal death kinetics. The D-value is defined as the heating time required to achieve a ninety percent, or one-log, reduction in the viable spore population at a specific constant temperature, which is typically set at one hundred and twenty-one point one degrees Celsius.

103. (B) Optimal growth temperatures exceeding 80°C, often near the boiling point of water.
A hyperthermophile is characterized by its ability to grow optimally at extreme temperatures exceeding eighty degrees Celsius, with some species thriving near the boiling point of water. These organisms possess unique structural adaptations, including highly stable proteins and unique membrane lipids, that allow them to maintain cellular function under conditions that would denature other forms of life.

104. (C) It allows mesophilic and thermophilic spore-formers to survive, germinate, and cause spoilage or toxicity during storage.
Inadequate thermal processing in low-acid canned foods has a direct cause-and-effect relationship with microbial survival. It fails to destroy highly resistant bacterial endspores, allowing mesophilic and thermophilic spore-formers to survive the process. During subsequent storage, these spores can germinate and multiply, producing toxins or causing gaseous and flat sour spoilage in the product.

105. (D) Psychrophilic lipases - Highly stable and hyperactive at 100°C
Enzymes isolated from different thermal groups possess varying stabilities. Extremozymes from hyperthermophiles remain active at ninety degrees Celsius, and thermophilic amylases are used in high-temperature starch processes. However, psychrophilic lipases are adapted to cold temperatures; they are highly heat-sensitive and undergo rapid, irreversible denaturation at elevated temperatures, making them unstable and inactive at one hundred degrees Celsius.

106. (A) A microorganism adapted to grow in extremely low water activity (a_w) environments, such as dried foods.
A xerophile is defined as a microorganism adapted to survive and grow in environments characterized by low water activity. These specialized organisms, which include several molds and yeasts, can multiply on dry foods like grains, nuts, and dried fruits. They employ unique physiological

Downloaded from www.pdf.tube

18. Identify the correct statement regarding the wet milling of maize.
(A) The primary objective is to maximize the yield of maize grits.
(B) It is a completely dry mechanical process relying on friction.
(C) It involves steeping maize in water containing sulphur dioxide.
(D) It reduces the starch recovery compared to dry milling.

19. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Parboiling significantly increases the head rice yield during milling.
Reason (R): The gelatinization of starch during parboiling seals the cracks in the endosperm, making the grain harder.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

20. Identify the incorrect pair regarding maize processing products.
(A) Corn steep liquor – By-product of wet milling rich in nutrients
(B) Corn gluten meal – High-protein animal feed
(C) Corn starch – Primary extract of wet milling
(D) Masa flour – Product of dry milling without chemical treatment

21. How is "steeping" defined in the context of maize wet milling?
(A) Soaking corn in warm water with $SO_2$to soften kernels and break the protein matrix.
(B) The mechanical cracking of dried maize kernels to easily release the internal oil-rich germ.
(C) The rapid separation of pure starch from gluten proteins using high-speed centrifugal force.
(D) The washing of newly extracted starch slurry to remove all remaining soluble proteins.

22. Consider the following changes that occur during the parboiling of rice:
I. Gelatinization of starch
II. Destruction of lipases
III. Inward migration of water-soluble vitamins
IV. Decrease in the physical hardness of the grain
Which of the above statements are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

23. What is the primary cause-and-effect relationship between the degree of milling in rice and its nutritional profile?
(A) Higher degree of milling causes loss of vitamins, minerals, and lipid fractions.
(B) Higher degree of milling causes a proportional increase in total dietary fiber.
(C) Higher degree of milling causes an increase in the overall protein quality of rice.
(D) Higher degree of milling causes a reduction in the standard glycemic index of rice.

NODIA

24. Given below are two statements:
Statement I: The primary goal of maize dry milling is to separate the endosperm from the germ and bran with minimal hydration.
Statement II: Removal of the germ is critical in dry milling to extend the shelf life of the resulting flours and grits.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

25. Which of the following is NOT a characteristic outcome of the maize wet milling process?
(A) Industrial production of high-purity maize starch
(B) Direct production of expanded corn snacks from the mill
(C) Large-scale production of standard hominy animal feed
(D) High-efficiency extraction of crude oil from the germ

26. When designing a rice parboiling facility, which process parameter must be strictly controlled to prevent the development of a dark color and strong odor in the final product?
(A) The pressure of the hulling rollers
(B) The speed of the friction polishers
(C) The steeping time and temperature
(D) The mesh size of the grading sieves

point, liquid at room temperature
(D) Fully hydrogenated oil – Zero trans fat, strictly saturated

81. How is "Vanaspati" legally and technically defined in the Indian food industry context?
(A) A natural healthy blend of unrefined cold-pressed seed oils.
(B) A liquid cooking oil fortified with essential Vitamins A and D.
(C) A stable emulsion of vegetable oil and water like margarine.
(D) A hydrogenated refined vegetable oil structured to mimic ghee.

82. Consider the following factors influencing trans fat formation during hydrogenation:
I. High temperature
II. High catalyst concentration
III. Low hydrogen pressure
IV. High agitation speed
Which of the above conditions promote the formation of trans isomers (isomerisation over saturation)?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

83. What is the effect of "selective hydrogenation" in processing multi-unsaturated oils like soybean oil?
(A) It equally and randomly saturates all available double bonds in triglycerides.
(B) It hydrogenates highly unsaturated fatty acids before less unsaturated ones.
(C) It exclusively converts cis double bonds to trans isomers without any hydrogen.
(D) It rapidly and continuously raises the overall iodine value of the processed oil.

84. Given below are two statements:
Statement I: Cold pressing extracts oil using mechanical pressure without adding external heat, maintaining the temperature strictly below 50°C.
Statement II: Standard expeller pressing generates high frictional heat, which can degrade sensitive nutrients in the oil.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

85. Which of the following is NOT true regarding the nutritional profile of cold-pressed oils compared to refined oils?
(A) They have significantly higher levels of trans fatty acids.
(B) They retain higher levels of natural tocopherols (Vitamin E).
(C) They contain higher levels of free fatty acids.
(D) They retain more phytosterols and natural plant pigments.

86. Which processing technology is the most viable alternative to partial hydrogenation to produce a zero-trans solid baking fat?
(A) Prolonged deodorisation
(B) Extensive winterisation
(C) Chemical or enzymatic interesterification
(D) Neutralisation with higher alkali concentration

87. Identify the incorrect statement concerning trans fats.
(A) Trans fats are entirely synthetic and are never found in naturally occurring foods like dairy or meat.
(B) Food safety regulations strictly limit trans fats in edible oils and fats to not more than 2% by weight.
(C) Trans fats have a higher melting point than their corresponding cis isomers.
(D) Epidemiological studies strongly link high trans fat intake with an increased risk of coronary heart disease.

88. A batch of Vanaspati labeled "Zero Trans Fat" is found to contain 45% trans fat. What processing step did the manufacturer likely use to produce this fat, contradicting the label?
(A) Complete hydrogenation
(B) Blending of liquid oils
(C) Interesterification of fully hydrogenated oil with liquid oil
(D) Partial hydrogenation

89. Identify the correct pair relating a fat's chemical property to its physical state.
(A) High proportion of saturated fatty acids – Lower melting point, liquid at room temp
(B) High degree of hydrogenation – Increased melting point, firmer texture
(C) High proportion of cis-unsaturated fatty acids – Higher melting point, solid at room temp

Click Here to Buy book on Amazon

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

(C) Burr mill – Splitting of the cotyledons
(D) Aspirator – Removing dust and light husk particles

36. In pulse processing, "dhal" is technically defined as:
(A) The whole grain legume with the seed coat intact.
(B) The powdered flour obtained from milling legumes.
(C) The isolated protein extract from legumes.
(D) The dehulled and split cotyledons of the legume.

37. Consider the following steps in the canning of pulses (e.g., baked beans):
I. Soaking and blanching
II. Filling into cans with hot sauce/brine
III. Exhausting
IV. Retorting for commercial sterilization
Which of the following represents the correct sequence of these steps?
(A) I, II, III, IV
(B) II, I, IV, III
(C) III, I, II, IV
(D) I, III, II, IV

38. What is the primary cause of the "hard-to-cook" defect often observed in improperly stored pulses?
(A) Lipid oxidation and enzymatic rancidity developing within the cotyledons
(B) Complete degradation of internal starch granules into simple free sugars
(C) Lignification and cross-linking of cell wall pectins by divalent cations
(D) Excessive thermal and mechanical breakdown of active trypsin inhibitors

39. Given below are two statements:
Statement I: Dry milling of pulses yields better quality dhal but takes a longer processing time due to conditioning steps.
Statement II: Wet milling of pulses is faster but results in higher quantitative losses due to breakage and scouring.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

40. Arrange the typical dry milling operations for hard-to-dehull pulses in the correct sequence:
1. Pitting
2. Cleaning
3. Dehulling and Splitting
4. Oil application and conditioning
5. Polishing
(A) 2, 1, 4, 3, 5
(B) 2, 4, 1, 3, 5
(C) 1, 2, 4, 3, 5
(D) 2, 1, 3, 4, 5

NODIA

41. To reduce the cooking time of hard-to-cook whole pulses, which additive is traditionally and industrially applied to the soaking water?
(A) Acetic acid
(B) Sodium bicarbonate (Baking soda)
(C) Calcium chloride
(D) Potassium sorbate

42. Identify the incorrect statement regarding pulse processing.
(A) Polishing of dhal improves its market appeal but may cause loss of marginal nutrients.
(B) Splitting is achieved by impacting or applying shear force to the dehulled pulse.
(C) Water soaking is never utilized in commercial pulse milling operations.
(D) Dehulling improves the digestibility of the pulses.

43. A pulse processing mill reports unusually high powdering and breakage during the dehulling of chickpeas. What is the most probable cause?
(A) The moisture content of the grain was too high during milling.
(B) The clearance in the emery roller was set too wide.
(C) The conditioning oil was applied too evenly.
(D) The grain was excessively dried and became too brittle.

44. Identify the correct pair regarding pulse canning.
(A) Retorting – Destroys Clostridium botulinum spores in the pack
(B) Blanching – Induces rapid enzymatic browning inside the can
(C) Exhausting – Increases total oxygen content in the headspace
(D) Soaking – Eliminates all heat-resistant thermophilic bacteria

45. During the canning of red kidney beans, ensuring the complete destruction of Phytohaemagglutinin (PHA) requires:

98. What is the primary physical effect achieved by "exhausting" a can before sealing?
(A) It rapidly cooks the fruit tissue to soften its overall physical texture.
(B) It completely sterilizes the inner surface of the metal lid before sealing.
(C) It removes headspace and product gases, ensuring a vacuum upon cooling.
(D) It chemically precipitates soluble pectins to clarify the covering syrup.

99. Given below are two statements:
Statement I: High-acid foods (pH < 4.5) require severe thermal processes (like retorting at 121°C) to ensure safety.
Statement II: Clostridium botulinum spores cannot germinate and produce toxin in high-acid environments.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

100. Arrange the typical operations for canning peach halves in the correct sequence:
1. Retorting/Processing
2. Lye peeling and washing
3. Exhausting and Sealing
4. Filling into cans with syrup
5. Sorting and Grading

(A) 5, 2, 4, 3, 1
(B) 2, 5, 4, 3, 1
(C) 5, 4, 2, 3, 1
(D) 5, 2, 3, 4, 1

101. Which gas mixture and pre-treatment is most appropriate to prevent enzymatic browning and maintain crispness of fresh-cut apple slices under MAP?
(A) Low O_2 (2-5%) and High CO_2 (5-10%) atmosphere with ascorbic acid and calcium dip
(B) Pure 100% Nitrogen flush packaging without any specialized chemical pre-treatment
(C) High O_2 (80%) gas mix with a standard low-concentration sodium chloride dip
(D) Complete vacuum seal packaging combined with a basic organic citric acid dip

102. Identify the incorrect statement regarding the Thermal Death Time (TDT) in fruit thermal processing.
(A) TDT is the time required to kill a specific number of microorganisms at a specific temperature.
(B) The D-value is the time required to reduce the microbial population by 90% at a given temperature.
(C) Higher D-values indicate that the microorganism is highly susceptible to heat.
(D) Z-value represents the temperature increase required to reduce the D-value by a factor of 10.

103. A batch of canned mango pulp (pH ≈ 4.0) shows several "hard swell" cans. Which spoilage mechanism is most likely responsible?
(A) Spoilage by acid-tolerant yeasts producing carbon dioxide gas
(B) Proteolytic growth of anaerobic Clostridium botulinum bacteria
(C) Hydrogen swell from organic acid reactions with unlacquered metal
(D) Flat sour microbial spoilage caused by Bacillus stearothermophilus

104. Identify the correct pair regarding peeling methods for specific fruits.
(A) Lye peeling – Thick-skinned oranges and citrus fruits
(B) Mechanical abrasion peeling – Delicate soft berries
(C) Flame peeling – Standard fresh apples and hard pears
(D) Flash steam peeling – Tomatoes and root vegetables

105. When designing a pasteurisation cycle for fresh mango juice (pH ≈ 3.8), which time-temperature combination is most appropriate to inactivate spoilage enzymes and microbes without destroying flavor?
(A) 121°C for 15 minutes
(B) $85^{\circ}C - 90^{\circ}C$ for 30 to 60 seconds
(C) 145°C for 3 seconds
(D) 60°C for 5 minutes

106. Match the dehydration methods in List I with their typical applications in List II.
List I: (Dehydration methods)
P. Spray drying
Q. Freeze drying (Lyophilization)
R. Tunnel drying
S. Drum drying
List II: (Typical applications)
I. High-value, heat-sensitive products like

Downloaded from www.pdf.tube

54. Given below are two statements:
Statement I: Haemagglutinins (lectins) are proteinaceous in nature and are highly resistant to dry heat.
Statement II: Proper soaking and subsequent boiling of pulses completely denature and eliminate haemagglutinin toxicity.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

55. Which of the following domestic processing methods does NOT significantly reduce the oligosaccharide (raffinose, stachyose) content of pulses?
(A) Dry roasting
(B) Prolonged soaking and discarding the steep water
(C) Germination (sprouting)
(D) Fermentation

56. During the production of legume protein concentrates, what is the primary purpose of using an aqueous alcohol wash?
(A) To completely dissolve and extract proteins, leaving carbohydrates behind.
(B) To chemically bleach active pigment compounds to a pure white color.
(C) To cross-link structural protein molecules for high-moisture extrusion.
(D) To wash out soluble sugars and flavors while precipitating the proteins.

57. Identify the incorrect statement comparing legume protein concentrates and isolates.
(A) Protein isolates have higher protein levels ($\geq$90%) than concentrates ($\geq$70%).
(B) Protein concentrates are costlier to produce due to multiple pH adjustment steps.
(C) Protein concentrates retain more dietary fiber from original cotyledons than isolates.
(D) Protein isolates are produced primarily using acid-based isoelectric precipitation.

58. Which combination of processes yields the best reduction of phytic acid when formulating a pulse-based infant weaning food?
(A) Dehulling followed by dry roasting
(B) High-pressure extrusion cooking without moisture
(C) Germination followed by mild cooking
(D) Deep fat frying of the pulse flour

59. Identify the correct pair linking a processing method with its primary target for reduction.
(A) Steeping in boiling water – Heat-stable aflatoxins
(B) Isoelectric washing – Total crude fat and lipid content
(C) Polishing – Thermostable trypsin inhibitor fractions
(D) Treatment with α-galactosidase – Oligosaccharides

60. Favism is an acute hemolytic condition triggered by consuming fava beans. Which specific demographic is exclusively susceptible to this condition despite processing?
(A) Individuals with a genetic G6PD enzyme deficiency
(B) Individuals suffering from severe lactose intolerance
(C) Individuals diagnosed with chronic celiac disease
(D) Infants who are currently under six months of age

61. Match the edible oil refining steps in List I with the specific impurities they primarily remove in List II.
List I: (Edible oil refining steps)
P. Degumming
Q. Neutralisation
R. Bleaching
S. Deodorisation
List II: (Impurities removed)
I. Free fatty acids (FFAs)
II. Phosphatides (gums)
III. Volatile odoriferous compounds
IV. Pigments (chlorophyll, carotenoids)
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-IV, R-I, S-III
(D) P-III, Q-I, R-IV, S-II

62. What is the most widely used solvent for the commercial extraction of oil from oilseeds?
(A) Ethanol
(B) Hexane
(C) Supercritical CO_2
(D) Acetone

63. Which of the following is correct regarding the degumming of crude edible oils?
(A) Adding water or acid to hydrate phosphatides, making them insoluble in oil.

NODIA

27. Identify the incorrect statement about rice milling equipment.
(A) Rubber roll shellers are used to minimize grain breakage while removing the husk.
(B) Friction polishers remove the bran layer by rubbing the grains against each other and the machine parts.
(C) Paddy separators utilize the difference in density and surface smoothness between paddy and brown rice.
(D) Abrasive polishers are primarily used to separate the husk from the paddy.

28. A batch of milled rice shows a 30% broken grain rate. Which of the following is the most likely cause for this defect during processing?
(A) Milling paddy at an improper, too low moisture content
(B) Excessive steeping and heating during the parboiling stage
(C) Using a highly efficient and modern rubber roll sheller
(D) Storing raw paddy at extremely low temperatures before milling

29. Identify the correct pair regarding maize by-products and their composition.
(A) Corn gluten – Predominantly carbohydrate
(B) Corn germ – High in lipids (oil)
(C) Corn steep liquor – Purely fibrous material
(D) Corn bran – High in soluble sugars

30. What is the most appropriate reason for using SO_2 during the steeping of maize?
(A) It bleaches pigment compounds in corn kernels to ensure a much whiter final starch.
(B) It disrupts protein disulfide bonds to release starch and prevents microbial spoilage.
(C) It chemically enhances and stabilizes the flavor profile of the produced corn syrup.
(D) It increases the outer cell wall water absorption capacity of the tough maize bran.

31. Match the pulse processing terms in List I with their corresponding definitions in List II.
List I: (Pulse processing terms)
P. Pitting
Q. Conditioning
R. Splitting
S. Polishing
List II: (Definitions)
I. Improving the appearance using water, oil, or soapstone
II. Scratching the seed coat to facilitate moisture penetration
III. Alternate wetting and drying to loosen the seed coat
IV. Separating the cotyledons after dehulling
(A) P-II, Q-III, R-IV, S-I
(B) P-III, Q-II, R-I, S-IV
(C) P-II, Q-IV, R-III, S-I
(D) P-I, Q-II, R-III, S-IV

32. What is the most common pre-milling treatment used in India to loosen the husk of pulses before dehulling?
(A) Prolonged boiling of the seeds in water
(B) Chemical treatment with concentrated acids
(C) Application of edible oil and sun drying
(D) High-pressure steam explosion technology

33. Identify the correct statement regarding the dehulling of pulses.
(A) Dehulling processes significantly increase the concentration of active anti-nutritional factors.
(B) Wet milling techniques of pulses yield a much higher dhal recovery compared to dry milling.
(C) Dehulling acts to increase the total cooking time and energy required for processing pulses.
(D) Pulses with strongly adherent seed coats require extensive pre-treatment before dehulling.

34. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): A small quantity of edible oil is mixed with pitted pulses before sun drying.
Reason (R): The oil penetrates the scratched seed coat, reducing the binding forces between the cotyledon and the husk.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

35. Identify the incorrect pair regarding pulse processing equipment.
(A) Emery roller – Abrasive removal of the husk
(B) Destoner – Coating the dhal with a shiny finish

Click Here to Buy book on Amazon

72. Identify the incorrect statement regarding the "winterisation" of oils.
(A) It involves cooling the oil to crystallize out higher-melting point triglycerides and waxes.
(B) It prevents the oil from becoming cloudy when stored at refrigerator temperatures.
(C) Sunflower oil often undergoes winterisation to remove waxes derived from the seed hull.
(D) It is a crucial step in the production of solid fats like Vanaspati.

73. If a batch of refined soybean oil fails quality testing due to high residual solvent levels, which equipment in the processing line is most likely malfunctioning?
(A) The high-speed degumming centrifuge
(B) The desolventizer-toaster system
(C) The pressurized bleaching filter press
(D) The mechanical seed flaking rolls

74. Identify the correct pair mapping the equipment to its function in oilseed processing.
(A) Expeller – Separating the tough outer hull from the inner meat of the seed
(B) Desolventizer-Toaster (DT) – Refining the crude vegetable oil into edible grade
(C) Flaking rolls – Rupturing cells to increase surface area for extraction
(D) Deodorizer – Removing hydratable phosphatides using high-speed centrifugation

75. Which parameter is critical to control during bleaching to ensure it does not induce isomerisation or excessive oxidation in the oil?
(A) Increasing the bleaching temperature above 150°C
(B) Exposing the oil to atmospheric oxygen to activate the clay
(C) Adding a high dosage of caustic soda to the bleaching earth
(D) Maintaining a high vacuum (low pressure) during the process

76. Match the terms related to fat modification in List I with their descriptions in List II.
List I: (Terms related to fat modification)
P. Hydrogenation
Q. Interesterification
R. Fractionation
S. Winterisation
List II: (Descriptions)
I. Rearrangement of fatty acids on the glycerol backbone
II. Addition of hydrogen across double bonds
III. Separation of liquid and solid phases by controlled cooling
IV. Removal of trace waxes to prevent cloudiness
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-III, R-I, S-IV
(D) P-III, Q-I, R-II, S-IV

77. Which metal catalyst is most commonly used in the industrial hydrogenation of edible oils?
(A) Platinum
(B) Nickel
(C) Palladium
(D) Copper

78. Identify the correct statement regarding the formation of trans fats during hydrogenation.
(A) Trans fats are formed exclusively during complete hydrogenation to a fully saturated state.
(B) Trans fatty acids are geometric isomers formed as a side reaction during partial hydrogenation.
(C) Trans fats lower LDL cholesterol and increase HDL cholesterol in the human body.
(D) Interesterification produces higher amounts of trans fats compared to partial hydrogenation.

79. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Cold-pressed oils generally possess a stronger aroma and flavor profile than fully refined oils.
Reason (R): Cold-pressed oils do not undergo the high-temperature deodorisation process that strips away volatile flavor compounds.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

80. Identify the incorrect pair regarding fat properties and degree of hydrogenation.
(A) Liquid vegetable oil – High iodine value, high unsaturation
(B) Partially hydrogenated oil – Contains both saturated and trans-unsaturated fats
(C) Fully hydrogenated oil – Very low melting

Downloaded from www.pdf.tube

(A) Retorting canned products at temperatures strictly below 80°C
(B) Boiling the soaked beans at 100°C for at least 10 to 15 minutes
(C) Treating harvested beans with highly concentrated streams of gaseous CO_2
(D) Applying high-intensity ultraviolet (UV) radiation directly to dry beans

46. Match the anti-nutritional factor (ANF) in List I with its physiological effect in List II.
List I: (Anti-nutritional factor (ANF))
P. Phytic acid
Q. Trypsin inhibitors
R. Haemagglutinins (Lectins)
S. Saponins
List II: (Physiological effect)
I. Interfere with protein digestion
II. Bind to intestinal mucosa and cause red blood cell clumping
III. Chelate minerals like iron, zinc, and calcium
IV. Impart a bitter taste and can cause hemolysis
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-III, R-IV, S-II
(C) P-III, Q-II, R-I, S-IV
(D) P-II, Q-I, R-III, S-IV

47. Which processing method is most effective for inactivating trypsin inhibitors in soybeans?
(A) Adequate moist heat treatment
(B) Prolonged open-air sun drying
(C) Low-temperature cold storage
(D) Standard mechanical dehulling

48. Identify the correct statement about phytic acid in pulses.
(A) Phytic acid enhances the bioavailability of dietary iron.
(B) Phytic acid is a highly toxic protein that causes immediate food poisoning.
(C) Germination and fermentation activate phytase, which degrades phytic acid.
(D) Boiling pulses completely destroys all phytic acid present.

49. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Fermentation of pulses is a widely recommended method to improve their nutritional quality.
Reason (R): Fermentation reduces anti-nutritional factors like phytates and flatulence-causing oligosaccharides.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

50. Identify the incorrect pair of a toxin/ANF and its primary legume source.
(A) BOAA (beta-N-oxalylamino-L-alanine) – Khesari dhal (Lathyrus sativus)
(B) Vicine and Convicine – Fava beans (Broad beans)
(C) Gossypol – Soybeans
(D) Cyanogenic glycosides – Lima beans

51. How is a "legume protein isolate" defined?
(A) A basic milled legume product containing approximately 50-65% total protein.
(B) A purified extract containing at least 90% protein on a moisture-free basis.
(C) The coarse residual pressed cake left after commercial soybean oil extraction.
(D) A textured vegetable product used as a meat replacer with high fiber content.

52. Consider the following common steps in the production of soy protein isolate:
I. Extraction with dilute alkali at pH 8-9
II. Centrifugation to remove insoluble fiber
III. Precipitation of protein at isoelectric pH (around 4.5)
IV. Washing, neutralizing, and spray drying the curd
Which of the following represents the correct sequence of these steps?
(A) I, II, III, IV
(B) I, III, II, IV
(C) II, I, IV, III
(D) III, II, I, IV

53. What is the direct cause of the neurological disorder Lathyrism?
(A) Consumption of Khesari dhal containing the active neurotoxin BOAA.
(B) Consumption of undercooked red kidney beans rich in toxic lectins.
(C) Ingestion of cyanogenic glycosides from raw and unprocessed cassava.
(D) Ingestion of highly carcinogenic aflatoxins in stored groundnuts.

NODIA

(D) High iodine value – Hard, brittle texture at room temperature

90. What is the most appropriate reason why unfiltered cold-pressed oils may have a shorter shelf life than highly refined oils under certain storage conditions?
(A) Mechanical cold pressing operations completely destroy all vital natural antioxidants.
(B) They naturally contain exceptionally high amounts of toxic chemical solvent residues.
(C) They contain moisture, plant particles, and enzymes that accelerate degradation.
(D) Most cold-pressed oils consist entirely of trans fat structures which are highly unstable.

91. Match the primary fruit processing operations in List I with their specific purpose in List II.
List I: (Primary fruit processing operations)
P. Sorting
Q. Grading
R. Washing
S. Blanching
List II: (Specific purpose)
I. Categorizing based on size, color, and maturity
II. Removing severely damaged or decayed fruits
III. Inactivating surface enzymes and expelling tissue gases
IV. Removing soil, pesticide residues, and microbial load
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-IV, R-I, S-III
(D) P-III, Q-I, R-IV, S-II

92. What is the primary target microorganism for pasteurisation in acidic fruits (pH < 4.5)?
(A) Acid-tolerant spoilage yeasts and molds
(B) Spore-forming Clostridium botulinum
(C) Pathogenic Bacillus cereus strains
(D) Psychrotrophic Listeria monocytogenes

93. Identify the correct statement regarding Modified Atmosphere Packaging (MAP) of minimally processed fruits.
(A) MAP aims to completely replace package headspace with pure active oxygen.
(B) MAP reduces O_2 and elevates CO_2 levels to slow down respiration.
(C) MAP completely eliminates any need for subsequent refrigerated storage.
(D) MAP involves generating a permanent hard vacuum inside a rigid metal can.

94. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The thermal processing (canning) of fruits creates a commercially sterile product.
Reason (R): Canning uses heat to destroy all pathogenic and spoilage microorganisms capable of growing in the food under normal non-refrigerated storage conditions.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

95. Identify the incorrect pair regarding fruit grading criteria and their measurement tools.
(A) Titratable Acidity – Hydrometer
(B) Soluble solids (TSS) – Refractometer
(C) Firmness/Texture – Penetrometer
(D) Color – Colorimeter or visual matching charts

96. How is "commercial sterility" defined in the context of thermal processing?
(A) The absolute and complete destruction of all living organisms and their spores.
(B) The reduction of the total microbial load to safe levels suited for frozen storage.
(C) Destruction of pathogens and spoilage organisms capable of growing at room temp.
(D) The physical separation and removal of bacteria from liquid foods using filters.

97. Consider the following steps in the canning of fruits:
I. Preparation (peeling, coring, slicing)
II. Exhausting
III. Filling with hot syrup
IV. Sealing and Retorting
Which of the following represents the correct sequence required to ensure an anaerobic environment before sealing?
(A) I, III, II, IV
(B) I, II, III, IV
(C) III, I, IV, II
(D) II, I, III, IV

Click Here to Buy book on Amazon

(B) Treating crude oil with activated carbon to bind and remove surface impurities.
(C) Using thermal processing to reduce the overall peroxide value of crude oil.
(D) Discarding all removed gums as they hold absolutely no commercial value.

64. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Bleaching of edible oil is typically carried out under a vacuum.
Reason (R): Vacuum prevents the oxidation of the oil at the elevated temperatures required for the bleaching earth to absorb pigments effectively.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

65. Identify the incorrect pair regarding oil extraction methods.
(A) Expeller pressing – Leaves a high level of residual oil in the cake
(B) Solvent extraction – Leaves less than 1% residual oil in the final meal
(C) Cold pressing – Extracted strictly without external application of heat
(D) Pre-press solvent extraction – Used only for seeds with low oil content

66. In the context of solvent extraction, what does the term "miscella" refer to?
(A) The remaining oil-free protein meal left after extraction.
(B) The condensed vapors recovered directly from the desolventizer.
(C) The solution of extracted oil and solvent (e.g., hexane).
(D) The complex water-in-oil emulsion formed during degumming.

67. Consider the following statements regarding the neutralization process in oil refining:
I. It removes free fatty acids to improve oil stability.
II. It typically involves the addition of sodium hydroxide (caustic soda).
III. The reaction produces soapstock as a by-product.
IV. It increases the natural antioxidant levels in the oil.
Which of the above statements are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

68. What is the primary cause-and-effect relationship established during the deodorisation step of oil refining?
(A) Injection of high-pressure oxygen causes the rapid oxidation of pigments.
(B) Addition of dilute citric acid causes the precipitation of residual waxes.
(C) Rapid chilling at low temperatures causes solidification of saturated fats.
(D) High heat and steam under deep vacuum volatilize and remove off-flavors.

69. Given below are two statements:
Statement I: Mechanical pressing yields a higher quality crude oil with fewer impurities compared to solvent extraction.
Statement II: Solvent extraction is less efficient in terms of oil recovery compared to mechanical pressing.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

NODIA

70. Arrange the unit operations of chemical refining of crude vegetable oil in the correct sequential order:
1. Deodorisation
2. Degumming
3. Bleaching
4. Neutralisation
(A) 2, 4, 3, 1
(B) 4, 2, 3, 1
(C) 2, 3, 4, 1
(D) 4, 3, 2, 1

71. Which refining technique is most commercially appropriate to process a crude rice bran oil sample with an exceptionally high Free Fatty Acid (FFA) content (e.g., >15%) to avoid massive neutral oil losses?
(A) Physical refining via steam deacidification
(B) Chemical refining using traditional alkali
(C) Low temperature chemical neutralization
(D) Double bleaching with activated earth

strawberry pieces (preserves shape)
II. Fruit juices turning into instant powders
III. Continuous drying of sliced vegetables on trays
IV. Producing fruit leathers or potato flakes from slurries
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-III, R-I, S-IV
(D) P-III, Q-I, R-II, S-IV

107. Which enzyme is commonly used as an indicator to test the adequacy of blanching in vegetables prior to freezing or dehydration?
(A) Amylase
(B) Lipoxygenase
(C) Protease
(D) Peroxidase

108. Identify the correct statement regarding the IQF (Individually Quick Frozen) process.
(A) IQF prevents individual pieces from clumping into a solid block.
(B) IQF utilizes very slow freezing rates to produce large ice crystals.
(C) IQF technology is exclusively applicable to liquid food products.
(D) IQF processing completely eliminates the need for steam blanching.

109. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sun drying of vegetables often results in significant losses of Vitamin A (carotenes) and Vitamin C.
Reason (R): Prolonged exposure to oxygen and ultraviolet radiation during sun drying degrades these sensitive vitamins.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

110. Identify the incorrect pair regarding a vegetable and its typical optimal processing method.
(A) Green Peas – Quick freezing using modern IQF methods
(B) Tomatoes – Sun drying without pre-treatment for red powder
(C) Potatoes – Drum drying of cooked mash to yield flakes
(D) Onion slices – Convective hot air drying in a tunnel

111. In the dehydration of fruits and vegetables, what is "case hardening"?
(A) A defect where rapid surface drying forms a shell trapping moisture inside.
(B) The intentional coating of food surfaces with sugar to stop moisture loss.
(C) The rapid enzymatic toughening of internal plant cell walls before drying.
(D) The mechanical hardening of freezing machinery parts due to frost build-up.

112. Consider the factors affecting the quality of spray-dried fruit powders:
I. Inlet air temperature
II. Feed concentration (Brix)
III. Atomizer speed / droplet size
IV. Use of carrier agents (like maltodextrin)
Which of the above factors directly influence the stickiness and recovery of the powder?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, III, and IV

113. What is the primary cause-and-effect relationship regarding the blanching of vegetables?
(A) Exposure to boiling water causes major cellular collapse, keeping vegetables fresh.
(B) Brief heating initiates the Maillard reaction, producing highly brown surfaces.
(C) Leaching of simple sugars causes a substantial increase in total vegetable calories.
(D) Thermal treatment inactivates enzymes, preventing browning and off-flavors in storage.

114. Given below are two statements:
Statement I: In a counter-current tunnel dryer, the hottest and driest air enters at the product discharge end.
Statement II: Counter-current drying is highly efficient but carries a higher risk of scorching the nearly dry product compared to co-current drying.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

Downloaded from www.pdf.tube

TSS)
(B) Wheat flour – Standard chemical Polenske value
(C) Mustard oil – Total diastase enzyme activity
(D) Canned peas – Percentage of gluten protein content

150. To implement a robust quality and traceability system in a grain milling facility, which action should be prioritized?
(A) Mixing all incoming batches of wheat into a single silo to average out the quality profile.
(B) Discarding all internal quality records after one week to save digital storage space.
(C) Using a lot-numbering system to link raw material testing with dispatched batches.
(D) Relying solely on quick visual inspections of the flour to find its chemical content.

www.nodia.in

NODIA

124. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Cryogenic grinding is highly preferred for grinding high-oil spices like nutmeg and cloves.
Reason (R): Liquid nitrogen cools the grinding mill, preventing the volatilization of essential oils and preventing the spice from becoming a sticky paste.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

125. Identify the incorrect pair linking a condiment to its primary preservative factor.
(A) Tomato Ketchup – Acetic acid (Vinegar) and Sugar (low a_w)
(B) Mayonnaise – Thermal retorting at 121°C
(C) Traditional Indian Mango Pickle – Salt, Oil, and Spices
(D) Soya Sauce – High salt concentration and fermentation metabolites

126. How is "steam distillation" defined in the context of spice processing?
(A) Passing dry thermal heat over spices to collect and condense smoke extracts.
(B) Passing steam through spices to vaporize, condense, and separate volatile oils.
(C) Using organic chemical solvents to dissolve both fixed and volatile oils at once.
(D) Boiling whole spices in mineral oils to extract valuable non-volatile resins.

127. Consider the following factors influencing the quality of fermented pickles (e.g., cucumber pickles):
I. Salt concentration in the brine (typically 5-8% initially)
II. Temperature of fermentation (optimal 21-24°C)
III. Dominance of Lactic Acid Bacteria (LAB)
IV. Complete exclusion of oxygen to prevent yeast and mold growth
Which of the above represent essential conditions for proper fermentation?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, III, and IV

128. What is the primary cause-and-effect relationship in the extraction of spice oleoresins?
(A) Steam distillation processes cause the complete extraction of fixed and volatile oils.
(B) Mechanical pressing methods cause the complete isolation of piperine from black pepper.
(C) Organic solvent extraction dissolves both volatile oils and non-volatile principles.
(D) Sun drying techniques cause the heavy concentration of oleoresins on spice surfaces.

129. Given below are two statements:
Statement I: According to food safety standards, tomato sauce must have a higher Total Soluble Solids (TSS) and acidity compared to a basic tomato puree.
Statement II: Chutneys generally contain fruit or vegetable pieces, sugar, spices, and vinegar, resulting in a chunky texture, unlike the smooth consistency of sauces.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

130. Arrange the essential steps of extracting essential oil via steam distillation in the correct order:
1. Condensation of the vapor mixture
2. Preparation/Crushing of the spice
3. Separation of oil and water in a florentine flask
4. Passing steam through the spice bed
(A) 2, 4, 1, 3
(B) 4, 2, 1, 3
(C) 2, 1, 4, 3
(D) 2, 4, 3, 1

131. To prevent mold growth (scum formation) on the surface of traditional brined mango pickles, which of the following is the most effective and traditional hurdle technology applied?
(A) Adding chemical sodium bicarbonate to raise the overall pH
(B) Floating a continuous layer of edible oil on top of the pickle
(C) Storing the finished pickle under direct sunlight permanently
(D) Adding massive volumes of plain water to dilute active active brine

Click Here to Buy book on Amazon

132. Identify the incorrect statement regarding defects in tomato sauce.
(A) "Black neck" is caused by the interaction of tannins from spices with iron from equipment or poorly tinned caps.
(B) Serum separation (syneresis) indicates poor quality pectin or insufficient homogenization.
(C) Darkening of color can result from excessive cooking and Maillard reactions.
(D) Spoilage by lactic acid bacteria is common in commercial sauces because they thrive at a pH of 7.0.

133. Which specific test parameters would confirm the addition of light berries (exhausted pepper) and excessive microbial load in a suspect batch of black pepper?
(A) Low bulk density, low piperine, and high coliform count
(B) High bulk density, high piperine, and low coliform count
(C) High bulk density, low piperine, and high coliform count
(D) Low bulk density, high piperine, and low coliform count

134. Identify the correct pair mapping the spice processing equipment to its specific function.
(A) Pin mill – Gentle mixing of delicate whole spices without any size reduction
(B) Florentine flask – Distilling solvent residues from crude oleresin miscella
(C) Gravity separator – Removing heavy impurities from spices based on density
(D) Ribbon blender – Complete sterilisation of ground spices using direct dry heat

135. When utilizing Supercritical Fluid Extraction (SFE) with CO_2 for ginger oleoresin, which critical parameters must the technologist precisely manipulate to adjust the solvent's solvating power?
(A) Temperature and Pressure
(B) pH and Titratable Acidity
(C) Refractive index and Viscosity
(D) Agitation speed and Steam injection rate

136. Match the food processing by-products in List I with their source raw material in List II.
List I: (Food processing by-products)
P. Pomace
Q. Bran
R. Oilcake/Meal
S. Molasses
List II: (Source raw material)
I. Oilseeds (e.g., Soybeans, Groundnuts)
II. Grains (e.g., Wheat, Rice)
III. Fruits (e.g., Apples, Grapes)
IV. Sugarcane
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-III, R-I, S-IV
(C) P-III, Q-I, R-II, S-IV
(D) P-I, Q-II, R-IV, S-III

NODIA

137. Which agency in India is responsible for the implementation of the Agricultural Produce (Grading and Marking) Act, leading to the 'AGMARK' certification?
(A) Bureau of Indian Standards (BIS)
(B) Directorate of Marketing and Inspection (DMI)
(C) Food Safety and Standards Authority of India (FSSAI)
(D) Quality Council of India (QCI)

138. Identify the correct statement regarding the utilization of rice bran.
(A) Rice bran is primarily composed of starch granules and has no commercial food value.
(B) Edible oil extraction is impossible from rice bran because of very high silica content.
(C) Rice bran has active lipase causing rapid rancidity unless stabilized immediately.
(D) Rice bran oil extracted from fresh bran is completely devoid of natural antioxidants.

139. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Wheat germ oil is highly valued in the cosmetic and nutritional supplement industries.
Reason (R): Wheat germ oil is one of the richest natural sources of tocopherols (Vitamin E), which act as powerful antioxidants.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

140. Identify the incorrect pair regarding quality standards and food commodities.
(A) ISO 22000 – Statutory standard for grading fresh fruit in local mandis

(B) FSSAI – Mandatory safety standards for processed food items sold in India
(C) AGMARK – Voluntary quality grade standards for raw agricultural commodities
(D) Codex Alimentarius – International food quality standards recognized by WTO

141. How is "value addition" best defined in the context of agricultural processing?
(A) The artificial inflation of wholesale market prices during low-yield off-seasons.
(B) Increasing raw commodity economic value and appeal through processing or packaging.
(C) The addition of approved synthetic food colors to mask low-quality raw ingredients.
(D) The total and strict elimination of all industrial by-products during manufacturing.

142. Consider the following quality parameters for refined wheat flour (Maida):
I. Maximum moisture content limit
II. Maximum total ash limit
III. Maximum acid insoluble ash limit
IV. Minimum gluten content
Which of the above parameters are commonly used to ensure standard quality and prevent adulteration?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, III, and IV

143. Which of the following is correct regarding the utilization of pulse milling husk (seed coat)?
(A) Its high fiber and calcium content allows its effective use in cattle feed.
(B) Its high toxicity causes severe environmental pollution if it is not incinerated.
(C) Its high protein concentration makes it ideal for human protein isolate production.
(D) Its high water-solubility makes it a perfect thickening agent for fruit jams.

144. Given below are two statements:
Statement I: Edible oilseed cake (meal) produced via solvent extraction is widely used to produce high-protein flours for human consumption.
Statement II: Oilseed cakes intended for human consumption must be produced using food-grade hexane and strictly monitored for residual solvent limits and anti-nutritional factors.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

145. Which of the following is NOT a standard physicochemical quality parameter evaluated for graded edible vegetable oils?
(A) Iodine Value
(B) Saponification Value
(C) Refractive Index
(D) Gluten Index

146. What functional benefit does apple pomace primarily provide when utilized in baked products like muffins?
(A) It significantly increases the gluten network strength of the dough.
(B) It acts directly as an active chemical leavening agent in baking.
(C) It serves as a source of dietary fiber and retains crumb moisture.
(D) It completely replaces any commercial need for chemical baking powder.

NODIA

147. Identify the incorrect statement regarding the grading of plant-based foods.
(A) Grading facilitates price determination based on defined quality metrics.
(B) Grading strictly involves the chemical alteration of the food to meet specific standards.
(C) Grading of fresh produce like apples is primarily based on size, color, and freedom from blemishes.
(D) AGMARK grades for spices consider parameters like extraneous matter, moisture, and total ash.

148. Which hazard is of primary concern in groundnut cake intended for dairy feed due to the risk of contaminating milk?
(A) High levels of synthetic or naturally occurring Vitamin C compounds.
(B) Excessive levels of residual indigestible dietary fiber fractions.
(C) The presence of standard harmless lactic acid bacteria strains.
(D) Contamination with Aflatoxin B_1, which converts to M_1 in milk.

149. Identify the correct pair mapping a processed plant food to a critical quality parameter used for its grading.
(A) Jam – Minimum total soluble solids (68%

functions. It acts as a reducing agent that cleaves disulfide bonds in the protein matrix surrounding the starch. This action releases the starch granules for efficient extraction while simultaneously inhibiting the growth of spoilage microorganisms during the extended steeping period.

31. (A) P-II, Q-III, R-IV, S-I
Pitting scratches the tough seed coat of pulses to facilitate moisture penetration during conditioning. Conditioning involves alternating wetting and drying cycles to loosen the seed coat from the cotyledons. Splitting separates the individual cotyledons after the dehulling process is completed. Polishing improves the final appearance of the dhal using water, oil, or soapstone treatment.

32. (C) Application of edible oil and sun drying
The traditional pre-milling treatment for pulses in India involves applying a small quantity of edible oil, followed by sun drying. The oil penetrates the pitted seed coat and disrupts the gum adhesive layer between the cotyledon and the husk. Sun drying then shrinks the cotyledons, loosening the husk to facilitate easy dehulling during mechanical milling.

33. (D) Pulses with strongly adherent seed coats require extensive pre-treatment before dehulling.
Many pulses possess a strongly adherent seed coat bound to the cotyledons by a layer of natural gums and mucilages. These hard-to-dehull grains require extensive mechanical and thermal pre-treatments, such as pitting, oiling, and sun drying, to loosen this bond. Proper pre-treatment is essential to prevent excessive grain breakage and powdering during dehulling.

34. (A) Both A and R are true and R is the correct explanation of A.
Mixing edible oil with pitted pulses prior to sun drying is a critical conditioning step. The oil penetrates the scratched seed coat, dissolving or weakening the adhesive gum layer that binds the husk to the cotyledons. This chemical and physical disruption reduces the binding forces, allowing the husk to separate easily during subsequent abrasive mechanical milling.

35. (B) Destoner – Coating the dhal with a shiny finish
A destoner is a cleaning machine designed to separate high-density impurities like stones and pebbles from pulses based on differences in specific gravity. It does not coat the dhal to provide a shiny finish. Applying a polished finish to the dhal is performed using specialized polishing machines that utilize water, oil, or soapstone.

36. (D) The dehulled and split cotyledons of the legume.
In grain processing, dhal is defined as the clean, dehulled, and split cotyledons of legumes. This form is highly preferred for consumption because removing the fibrous, indigestible seed coat significantly reduces cooking time and improves overall protein digestibility. Splitting also enhances water absorption and ensures even heat transfer during domestic cooking.

37. (A) I, II, III, IV
Canning of pulses follows a strict sequential process. The legumes are first soaked and blanched to hydrate the starch and inactivate enzymes. They are then filled into cans along with hot brine or sauce. The filled cans undergo exhausting to remove air, are hermetically sealed, and finally processed in a retort for commercial sterilization.

38. (C) Lignification and cross-linking of cell wall pectins by divalent cations
The hard-to-cook defect in pulses develops during storage under high temperature and humidity. It is caused by chemical reactions that lead to the lignification of cell walls and the migration of divalent cations, like calcium and magnesium. These cations cross-link with cell wall pectins, forming insoluble complexes that restrict water absorption and cell separation during cooking.

39. (A) Both Statement I and Statement II are true.
Dry milling of pulses yields high-quality dhal with a long shelf life, but requires multiple steps of pitting, oiling, and sun drying. In contrast, wet milling involves soaking the grains in water to loosen the husk, which is faster but causes higher scouring losses and nutrient leaching, reducing the overall yield and quality of the final product.

40. (A) 2, 1, 4, 3, 5
The dry milling of hard-to-dehull pulses begins with thorough cleaning to remove field debris. The cleaned grains undergo pitting to scratch the seed coat, followed by oil application and sun drying to loosen the husk. Dehulling and splitting operations are then performed to separate the

Downloaded from www.pdf.tube

ANSWERS

1. (B) P-II, Q-I, R-IV, S-III
Threshing separates grain from the panicle by mechanical impact. Winnowing utilizes airflow to segregate lighter chaff from heavier grains based on aerodynamic differences. Curing toughens the outer skin of root crops to minimize moisture loss and prevent fungal infections during storage. Drying reduces the overall moisture content to a safe level, preventing microbial growth and deterioration.

2. (C) 90-95%
Traditional Indian milling of whole wheat to produce atta aims to retain almost the entire kernel, including the bran and germ. This results in a high extraction rate of around ninety to ninety-five percent. This process preserves the major nutritional components, dietary fibers, vitamins, and minerals that are otherwise lost during refined flour milling operations.

3. (B) Conditioning involves adding water to toughen the bran and mellow the endosperm.
Conditioning or tempering involves adding controlled amounts of water followed by a resting period. This critical pre-milling step toughens the outer bran layer, making it pliable and resistant to shattering. Simultaneously, it mellows and softens the starchy endosperm, facilitating efficient separation of the bran from the endosperm during the subsequent roller milling process.

4. (C) A is true but R is false.
Tempering wheat before milling increases the overall yield of high-quality white flour by altering the physical properties of the kernel components. This process toughens the outer bran layer, making it less brittle and highly resistant to shattering. Shattering is undesirable because pulverized bran contaminates the flour, reducing its visual appeal, quality, and overall market value.

5. (A) Clear flour – Premium white sandwich bread
Clear flour is a secondary grade obtained from the outer parts of the endosperm, containing higher ash and protein content but poorer baking quality. This makes it unsuitable for premium white sandwich bread, which requires highly refined patent flour. High-quality baking utilizes patent flour, whereas clear flour is typically reserved for rye or whole wheat blends.

6. (C) The percentage of whole grain converted into the final flour product.
Extraction rate represents the yield of flour obtained from a given quantity of clean, raw wheat grain. A higher extraction rate indicates that a larger proportion of the grain, including the outer bran and germ layers, is retained in the final flour. Conversely, lower extraction rates produce highly refined flours consisting primarily of the starchy endosperm.

7. (B) I, III, and IV
The break system in flour milling utilizes pairs of corrugated rolls rotating at differential speeds to open up the wheat kernel. This physical process scrapes the endosperm away from the tough outer bran layer without crushing it. The roll clearance decreases systematically with each successive stage to extract maximum endosperm while keeping the bran flakes intact.

NODIA

8. (D) It crushes middlings into fine flour without pulverizing the bran.
The reduction system utilizes smooth rolls rotating at slight differential speeds to process middlings and semolina. These rolls are designed to crush and reduce the purified endosperm particles into fine flour. Because the rolls are smooth, they do not pulverize any remaining tough bran particles, allowing them to be easily separated by subsequent sifting.

9. (A) Both Statement I and Statement II are true.
Purifiers are specialized machines in flour milling that combine oscillating sieves and controlled air currents. This combination separates endosperm particles from contaminating bran based on differences in specific gravity, surface area, and particle size. The lighter bran is lifted away by air, while the heavier, pure endosperm middlings pass through the sieves for reduction.

10. (A) 2, 3, 4, 5, 1
Industrial wheat milling follows a precise technological sequence to maximize pure flour extraction. The process begins with thorough

115. Which of the following is NOT an intended effect of blanching vegetables prior to processing?
(A) Softening the tissue to facilitate filling into cans
(B) Achieving commercial sterility to allow room temperature storage
(C) Removing intercellular gases to prevent oxidation and improve can vacuum
(D) Reducing the initial microbial load on the surface

116. Which preventive strategy is most effective to prevent "freezer burn" on frozen carrots over a 12-month shelf life?
(A) Freezing the carrot slices continuously at exactly 0°C
(B) Slow freezing the carrot slices uniformly over a 48-hour period
(C) Adding a high concentration of salt to carrots prior to freezing
(D) Using moisture-vapor proof packaging with minimal headspace

117. Identify the incorrect statement regarding the principle of spray drying.
(A) It is an excellent method for drying large chunks of fruits and vegetables.
(B) The liquid feed is atomized into a fine mist to maximize surface area.
(C) Drying occurs extremely rapidly, often in milliseconds.
(D) The product temperature remains well below the drying air temperature due to evaporative cooling.

118. A batch of frozen green beans exhibits severe loss of texture (mushiness) upon thawing. What is the most likely cause?
(A) The green beans were steam blanched for the exact correct amount of time.
(B) The freezing process utilized was too rapid, like cryogenic freezing.
(C) Beans were frozen slowly, letting large ice crystals rupture cell walls.
(D) The frozen storage temperature was maintained constantly at exactly -18°C.

119. Identify the correct pair relating a dehydration defect to its primary cause.
(A) Maillard browning – High drying temperatures and high reducing sugars
(B) Loss of volatile flavors – Using low-temperature freeze-drying methods
(C) Poor rehydration capacity – Using an osmotic dehydration pre-treatment
(D) Excessive tissue shrinkage – Applying commercial freeze-drying systems

120. What is the most appropriate reason for choosing a fluidized bed dryer over a conventional tunnel dryer for drying green peas?
(A) Fluidized beds intentionally cause rapid and severe case hardening in green vegetables.
(B) Fluidized beds are specifically designed for drying continuous liquid sheets of purees.
(C) Fluidized beds operate exclusively under deep vacuum and extremely low temperatures.
(D) Fluidized beds provide high heat transfer for fast, uniform drying of particulate foods.

121. Match the spices in List I with their characteristic primary active compound in List II.
List I: (Spices)
P. Turmeric
Q. Black Pepper
R. Clove
S. Chilli
List II: (Characteristic primary active compound)
I. Piperine
II. Curcumin
III. Capsaicin
IV. Eugenol
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-IV, R-I, S-III
(D) P-III, Q-I, R-II, S-IV

122. Under what state is Carbon Dioxide (CO_2) used for the high-efficiency extraction of essential oils and oleoresins from spices?
(A) Solid (Dry ice)
(B) Sub-cooled liquid
(C) Supercritical fluid
(D) Gaseous state at 1 atm

123. Identify the correct statement regarding spice sterilisation techniques.
(A) Ethylene Oxide (EtO) fumigation is widely used with absolutely no global restrictions.
(B) Gamma irradiation of food crops is strictly and completely prohibited in India.
(C) Dry roasting is the sole FSSAI-approved technique for commercial sterilisation.
(D) Steam sterilisation reduces microbial loads but can cause loss of volatile oils.

Click Here to Buy book on Amazon

pericarp, enhances nutritional availability, and alters the starch properties. This distinguishes it from standard dry milling, which relies solely on mechanical processes to grind maize without chemical additions.

21. (A) Soaking corn in warm water with $SO_2$to soften kernels and break the protein matrix.
Steeping in maize wet milling refers to soaking the grains in warm water acidified with sulfur dioxide for an extended period. This process facilitates water absorption, softening the kernel structure. The sulfur dioxide disrupts the disulfide bonds in the gluten matrix surrounding the starch granules, allowing for the clean and efficient separation of starch, germ, and fiber.

22. (A) I, II, and III
Parboiling induces key physical and chemical changes in rice grains. The hydrothermal treatment gelatinizes the starch, filling structural voids and increasing grain hardness. It also destroys active lipase enzymes, which prevents hydrolytic rancidity during storage. Simultaneously, water-soluble vitamins, particularly B-group vitamins, migrate inward from the outer bran layers into the central endosperm.

23. (A) Higher degree of milling causes loss of vitamins, minerals, and lipid fractions.
The outer layers of brown rice, including the bran and germ, are rich in dietary fiber, vitamins, minerals, and lipids. As the degree of milling increases, these nutrient-dense outer layers are progressively polished away, leaving behind the starchy endosperm. This mechanical polishing significantly reduces the overall nutritional value, mineral content, and healthy fats of the rice.

24. (A) Both Statement I and Statement II are true.
Maize dry milling focuses on separating the clean endosperm from the lipid-rich germ and fibrous bran using minimal water. Removing the germ is a critical step because its high oil content makes the resulting flour and grits highly susceptible to hydrolytic and oxidative rancidity. Efficient germ removal significantly extends the shelf life of these dry-milled products.

25. (B) Direct production of expanded corn snacks from the mill
Maize wet milling is designed for the high-purity fractionated separation of starch, gluten, germ, and fiber using chemical and physical processes. It does not directly manufacture final, ready-to-eat consumer products like expanded corn snacks. Expanded snacks are produced using high-temperature, high-pressure extrusion cooking of dry-milled corn grits, which is a separate food manufacturing process.

NODIA

26. (C) The steeping time and temperature
During parboiling, controlling steeping time and temperature is crucial to prevent undesirable changes. Excessive steeping or high temperatures can promote the growth of anaerobic microorganisms, leading to fermentation, off-odors, and souring. Furthermore, prolonged heat exposure facilitates non-enzymatic Maillard browning reactions, which results in dark, discolored rice grains that reduce market quality and acceptability.

27. (D) Abrasive polishers are primarily used to separate the husk from the paddy.
Abrasive polishers are designed to remove the tough outer bran layer from brown rice through friction and grinding, not to separate the husk from the paddy. Husking is performed using rubber roll shellers or centrifugal dehullers. Abrasive machines utilize coarse emery surfaces to gently scrape away bran to produce polished white rice grains.

28. (A) Milling paddy at an improper, too low moisture content
Milling paddy at a moisture content below the optimum level makes the grains brittle and highly susceptible to physical cracking under mechanical stress. This brittle state leads to a high percentage of broken grains during the hulling and polishing stages. Maintaining proper, uniform moisture levels is critical to maximize the recovery of whole head rice.

29. (B) Corn germ – High in lipids (oil)
The corn germ is the embryonal part of the maize kernel and serves as the primary reservoir for lipids. It contains up to forty-five percent oil, making it highly valuable for commercial corn oil extraction. In contrast, corn gluten consists primarily of protein, and corn bran represents the fibrous outer protective layer of the kernel.

30. (B) It disrupts protein disulfide bonds to release starch and prevents microbial spoilage.
Sulfur dioxide is added to the steeping water in maize wet milling to perform key chemical

cleaning to remove impurities, followed by tempering to optimize moisture. The tempered wheat undergoes breaking to open the kernels, purification to separate bran from endosperm, and finally, reduction to grind the purified endosperm into fine, high-quality flour.

11. (D) Glutenin and gliadin content
Glutenin and gliadin are the two primary proteins in wheat that form the gluten network upon hydration and mixing. This viscoelastic network is essential for trapping carbon dioxide gas during fermentation, allowing the dough to rise. A high concentration of these proteins provides the strength, elasticity, and gas retention required to produce hard, crusty bread.

12. (A) Wheat pollard is primarily used as a premium human food supplement.
Wheat pollard is a by-product of flour milling consisting of bran, germ, and some endosperm particles. Because of its high fiber content and coarse texture, it is primarily utilized as a valuable component in animal feed formulations rather than a premium human supplement. Human food supplements typically focus on isolated bran or pure wheat germ.

13. (B) Onset of insect infestation and fungal growth in moist grain
A rapid increase in temperature and carbon dioxide levels within a grain silo indicates active respiration. This phenomenon is driven by the metabolic activities of proliferating insects, mold, and fungi, which thrive in moist storage conditions. If left unchecked, this biological activity leads to hot spots, moisture migration, and severe quality degradation of the stored grain.

14. (B) Scourer – Removing outer surface dirt and the beard of wheat kernels
A scourer is an essential cleaning machine that uses abrasion to remove clinging dirt, dust, and the beard from wheat kernels. This mechanical action polishes the grain surface before milling, significantly reducing ash content and microbial load. Other equipment, like destoners, separate high-density impurities, while plansifters classify milled particles based on size using sifting screens.

15. (A) By measuring the ash content of the flour
The mineral content of the wheat kernel is concentrated primarily in the outer bran layers, while the starchy endosperm has very low mineral levels. Measuring the ash content of refined flour serves as a direct indicator of milling efficiency and bran contamination. High ash values indicate poor separation and the presence of unwanted pulverized bran.

16. (A) P-II, Q-IV, R-I, S-III
Hulling is the process of removing the outer protective husk from paddy. Polishing or milling removes the nutritious bran layers to produce white rice. Parboiling is a hydrothermal treatment involving soaking, steaming, and drying of paddy before milling. Grading classifies the milled rice grains based on physical size and the percentage of broken grains.

17. (D) Vitamin B1 (Thiamine)
Parboiling involves soaking, steaming, and drying paddy before milling. During the soaking and steaming stages, water-soluble nutrients, particularly thiamine, migrate from the outer bran and germ layers into the starchy endosperm. This hydrothermal migration ensures that the milled parboiled rice retains high nutritional value even after the outer bran layer is completely removed.

18. (C) It involves steeping maize in water containing sulphur dioxide.
Maize wet milling is an industrial chemical process designed to separate the kernel into starch, protein, fiber, and oil. A critical step involves steeping the maize in warm water containing dissolved sulfur dioxide. This chemical environment softens the kernel, prevents microbial growth, and breaks the protein matrix, facilitating high-purity extraction of starch and germ.

19. (A) Both A and R are true and R is the correct explanation of A.
Parboiling significantly increases head rice yield by reducing grain breakage during milling. The hydrothermal process causes starch gelatinization and protein denaturation within the endosperm, which heals internal cracks and fissures. This structural modification makes the rice grain harder and more resilient, allowing it to withstand the mechanical stresses of husk and bran removal.

20. (D) Masa flour – Product of dry milling without chemical treatment
Masa flour is produced through a specialized process called nixtamalization, which involves cooking maize in an alkaline solution, typically lime water. This chemical treatment softens the

Downloaded from www.pdf.tube

cotyledons, which are finally polished to improve market appearance.

41. (B) Sodium bicarbonate (Baking soda)
Adding sodium bicarbonate to the soaking water of hard-to-cook pulses accelerates the softening process. The alkaline medium promotes the dissolution of cell wall pectins and hemicelluloses, facilitating rapid water absorption. This chemical action disrupts the rigid cell wall matrix, significantly reducing the cooking time and thermal energy required to make the pulses soft and palatable.

42. (C) Water soaking is never utilized in commercial pulse milling operations.
Commercial pulse milling facilities frequently utilize controlled water soaking as a pre-treatment step, particularly in wet milling methods. Soaking hydrates the outer seed coat, causing it to swell and detach from the cotyledons more easily. This contradicts the claim that water soaking is never used commercially, as it remains a common practice for specific pulse varieties.

43. (D) The grain was excessively dried and became too brittle.
Excessive drying of pulses reduces their moisture content below the optimum level, making the cotyledons extremely brittle. Under the mechanical shear and impact forces of the emery roller, these brittle grains easily break and turn into powder. This significantly reduces the yield of whole dhal and increases processing losses within the milling facility.

44. (A) Retorting – Destroys Clostridium botulinum spores in the pack
Retorting is the thermal processing of sealed cans under steam pressure, designed to achieve commercial sterility. Its primary objective is the destruction of heat-resistant spores of Clostridium botulinum, which can survive and produce deadly toxins in anaerobic environments. This thermal treatment ensures that the canned pulses are completely safe for long-term room-temperature storage.

45. (B) Boiling the soaked beans at 100°C for at least 10 to 15 minutes
Phytohaemagglutinin is a highly toxic lectin found in raw red kidney beans that causes severe gastrointestinal distress. Complete inactivation of this heat-sensitive protein requires boiling the soaked beans at one hundred degrees Celsius for at least ten to fifteen minutes. Utilizing lower temperatures, such as slow cooking below eighty degrees, fails to destroy the toxin.

46. (A) P-III, Q-I, R-II, S-IV
Phytic acid chelates essential minerals like iron, zinc, and calcium, reducing their bioavailability in the human body. Trypsin inhibitors interfere with protein digestion by inactivating digestive enzymes. Haemagglutinins bind to the intestinal mucosa and cause red blood cell clumping. Saponins impart a bitter taste to pulses and can cause hemolysis under specific physiological conditions.

NODIA

47. (A) Adequate moist heat treatment
Soybeans contain trypsin inhibitors that hinder protein digestion by binding to pancreatic enzymes. These inhibitors are proteinaceous in nature and are highly susceptible to heat denaturation. Adequate moist heat treatment, such as autoclaving, steaming, or boiling, is the most effective commercial method to completely inactivate these anti-nutritional factors, thereby significantly improving soy protein digestibility.

48. (C) Germination and fermentation activate phytase, which degrades phytic acid.
Phytic acid is an anti-nutritional compound that binds minerals, reducing their absorption in the gut. While it is highly heat-stable and resistant to simple boiling, biological processes like germination and fermentation are highly effective. These processes activate endogenous phytase enzymes, which hydrolyze phytic acid into lower inositol phosphates, significantly increasing mineral bioavailability in pulses.

49. (A) Both A and R are true and R is the correct explanation of A.
Fermentation of pulses is a highly recommended processing technology because it significantly improves their nutritional profile. The metabolic activities of fermenting microorganisms produce enzymes that degrade phytic acid, increasing mineral bioavailability. Simultaneously, these microbes metabolize flatulence-causing oligosaccharides like raffinose and stachyose into simple sugars, enhancing digestibility and reducing gastrointestinal discomfort.

89. (B) High degree of hydrogenation – Increased melting point, firmer texture
A high degree of hydrogenation converts unsaturated liquid fatty acids into saturated solid forms. This chemical transformation increases the melting point of the fat, resulting in a significantly firmer and more stable physical texture at room temperature. Conversely, highly unsaturated oils with cis configurations have low melting points and remain liquid.

90. (C) They contain moisture, plant particles, and enzymes that accelerate degradation.
Unfiltered cold-pressed oils can have a shorter shelf life because they do not undergo refining steps like bleaching, degumming, and deodorization. Consequently, they retain trace amounts of water, microscopic plant tissue, and active enzymes. These impurities can promote hydrolytic and oxidative reactions, accelerating the degradation of the oil during storage.

91. (A) P-II, Q-I, R-IV, S-III
Sorting involves removing damaged, diseased, or decayed fruits from the processing line. Grading classifies the fruits into uniform groups based on physical size, color, and maturity. Washing removes surface soil, chemical residues, and microbial loads. Blanching is a mild thermal pre-treatment that inactivates enzymes and expels intercellular gases from the fruit tissue.

92. (A) Acid-tolerant spoilage yeasts and molds
In high-acid fruits with a pH below four point five, spore-forming pathogens like Clostridium botulinum cannot germinate or produce toxins. Therefore, pasteurization is designed to target acid-tolerant yeasts, molds, and vegetative bacteria responsible for spoilage. These heat-sensitive microorganisms are easily inactivated at pasteurization temperatures, ensuring product stability and safety.

93. (B) MAP reduces O_2 and elevates CO_2 levels to slow down respiration.
Modified Atmosphere Packaging of minimally processed fruits involves altering the gaseous composition within the package. The process reduces oxygen and elevates carbon dioxide levels to slow down the metabolic rate and respiration of the tissues. This atmospheric modification delays senescence, retards microbial growth, and extends the shelf life of the fresh-cut produce.

94. (A) Both A and R are true and R is the correct explanation of A.
Thermal processing creates a commercially sterile product by applying heat to destroy pathogens and spoilage organisms. This thermal treatment ensures that any remaining microorganisms or spores are incapable of growing under normal, non-refrigerated storage conditions. This makes the canned fruit microbiologically stable and completely safe for long-term storage at ambient temperatures.

95. (A) Titratable Acidity – Hydrometer
Titratable acidity is measured using chemical titration with an alkaline solution, not a hydrometer. A hydrometer is used to determine liquid density or specific gravity, such as sugar concentration in syrups. Other pairs are correct: refractometers measure soluble solids, penetrometers assess physical firmness, and colorimeters quantify fruit skin color.

96. (C) Destruction of pathogens and spoilage organisms capable of growing at room temp.
Commercial sterility is the condition achieved by thermal processing where all pathogenic and spoilage microorganisms capable of growing in the food under normal, non-refrigerated storage conditions are inactivated. It does not imply absolute sterility, as harmless thermophilic spores may survive, but these remain dormant and cannot grow during standard storage.

97. (A) I, III, II, IV
Canning fruits to ensure an anaerobic environment requires a specific sequence of operations. The fruit halves are prepared and filled into cans with hot syrup, which helps heat the container. The filled cans then undergo exhausting to drive out air and gases, and are immediately sealed and retorted to achieve commercial sterility and ensure a long shelf life.

98. (C) It removes headspace and product gases, ensuring a vacuum upon cooling.
Exhausting is a critical pre-sealing thermal step in canning. It heats the container contents to expand the product and expel entrapped air and gases from the fruit tissue and headspace. When the sealed can is subsequently cooled, the steam condenses to create an internal vacuum, which reduces oxidative reactions and extends shelf life.

Click Here to Buy book on Amazon

steeping, do not target heat-stable toxins or lipid fractions, making enzymatic treatment a highly precise method for nutritional improvement.

60. (A) Individuals with a genetic G6PD enzyme deficiency
Favism is an acute hemolytic anemia triggered by the ingestion of fava beans or inhalation of their pollen. It selectively affects individuals with an inherited genetic deficiency of the enzyme glucose-6-phosphate dehydrogenase. This deficiency renders red blood cells highly vulnerable to oxidative stress caused by vicine and convicine compounds present in the beans.

61. (A) P-II, Q-I, R-IV, S-III
Degumming hydrates and removes phosphatides from crude oil. Neutralization uses alkali to react with and remove free fatty acids as soapstock. Bleaching utilizes adsorbent clays to remove undesirable pigments, such as chlorophyll and carotenoids. Deodorization uses high-temperature steam distillation under vacuum to eliminate volatile odoriferous compounds, ensuring a bland and stable product.

62. (B) Hexane
Commercial oilseed extraction facilities predominantly utilize hexane as the primary solvent. Hexane is highly preferred because of its excellent oil solubility, low boiling point, and high volatility. These properties facilitate easy recovery of the solvent from both the extracted oil and the meal, ensuring efficient operations and minimizing residual solvent levels in the final products.

63. (A) Adding water or acid to hydrate phosphatides, making them insoluble in oil.
Degumming is the first major step in refining crude edible oils. It involves adding controlled amounts of water or phosphoric acid to hydrate phosphatides. Upon hydration, these compounds become insoluble in the oil and precipitate, allowing them to be easily separated by centrifugation. This process prevents the oil from darkening and foaming during subsequent high-temperature steps.

64. (A) Both A and R are true and R is the correct explanation of A.
Bleaching of edible oils is conducted under a vacuum to protect oil quality at elevated process temperatures. The vacuum environment prevents air exposure, thereby minimizing oxidative degradation and the formation of peroxide compounds. This ensures that the activated bleaching earth can efficiently absorb pigments, trace metals, and oxidation products without compromising the oil's stability.

65. (D) Pre-press solvent extraction – Used only for seeds with low oil content
Pre-press solvent extraction is an industrial process designed specifically for high oil-content seeds, such as rapeseed, sunflower seed, and groundnut. These seeds contain too much oil for direct solvent extraction. The process first uses mechanical pressing to extract the bulk of the oil, followed by solvent extraction to recover the remaining oil from the press cake.

66. (C) The solution of extracted oil and solvent (e.g., hexane).
In the solvent extraction of oilseeds, the term miscella refers to the liquid mixture of extracted crude oil and the chemical solvent, typically hexane. This mixture is collected from the extractor and processed through a series of evaporators and stripping columns. This thermal processing vaporizes and separates the solvent, leaving behind solvent-free crude vegetable oil.

67. (A) I, II, and III
The chemical neutralization of crude oils is designed to remove free fatty acids, which impair oil stability and cause off-flavors. This process involves adding sodium hydroxide, which reacts with the free fatty acids to produce soapstock as a by-product. However, this alkaline treatment also reduces the levels of natural antioxidants, such as tocopherols, in the oil.

68. (D) High heat and steam under deep vacuum volatilize and remove off-flavors.
Deodorization is a vacuum steam distillation process conducted at high temperatures. Injecting dry steam under a deep vacuum volatilizes and strips away volatile compounds, free fatty acids, and thermal decomposition products responsible for off-odors and flavors. This process significantly improves the sensory quality, blandness, and oxidative stability of the refined vegetable oil.

69. (C) Statement I is true but Statement II is false.
Mechanical pressing yields a higher-quality crude oil containing fewer non-glyceride impurities compared to solvent-extracted oil. However,

Downloaded from www.pdf.tube

aromas. The solvent is subsequently evaporated, leaving a concentrated extract that represents the complete flavor profile and pungency of the spice.

129. (A) Both Statement I and Statement II are true.
According to food safety standards, tomato sauce must have higher total soluble solids and acidity levels compared to a basic tomato puree. Additionally, chutneys are characterized by a chunky texture containing fruit or vegetable pieces, sugar, spices, and vinegar. This physical composition distinguishes them from the smooth, highly homogenized consistency of standard tomato sauces.

130. (A) 2, 4, 1, 3
Extracting essential oils via steam distillation follows a precise technological sequence. The process begins with preparing or crushing the spice to expose the oil glands. Next, steam is passed through the spice bed to vaporize the volatile oils. The vapor mixture is then condensed and transferred to a Florentine flask for density-based separation.

131. (B) Floating a continuous layer of edible oil on top of the pickle
To prevent mold and scum yeast growth on the surface of traditional brined mango pickles, floating a continuous layer of edible oil is highly effective. This oil layer acts as a physical barrier that prevents oxygen from reaching the pickle surface. This anaerobic environment inhibits the growth of aerobic spoilage microorganisms without using synthetic preservatives.

132. (D) Spoilage by lactic acid bacteria is common in commercial sauces because they thrive at a pH of 7.0.
Lactic acid bacteria are acid-tolerant microorganisms that thrive in acidic environments, typically below pH four point five, rather than at a neutral pH of seven. Commercial tomato sauces are formulated as high-acid foods. Therefore, spoilage by these bacteria is a concern because of their ability to survive and grow in acidic, low-pH conditions.

133. (A) Low bulk density, low piperine, and high coliform count
A suspect batch of black pepper contaminated with light berries and high microbial loads exhibits specific analytical parameters. Light or exhausted berries lack dense internal kernels, resulting in low bulk density and low piperine levels. Inadequate hygiene and poor post-harvest handling are reflected in a high coliform count, indicating contamination and safety risks.

134. (C) Gravity separator – Removing heavy impurities from spices based on density
A gravity separator is an essential cleaning machine used in spice processing. It operates by fluidizing the dry product over an inclined, vibrating deck, separating heavy impurities like stones and dust from the spice based on differences in density. Other equipment, such as pin mills, are used for high-shear size reduction, not gentle mixing.

135. (A) Temperature and Pressure
When using supercritical carbon dioxide for ginger oleoresin extraction, temperature and pressure are the critical parameters. Precisely manipulating these parameters adjusts the density and solvating power of the supercritical fluid. This control allows for the selective extraction of specific volatile terpenes and non-volatile pungent gingerols, optimizing the yield and quality of the extract.

NODIA

136. (A) P-III, Q-II, R-I, S-IV
Pomace is the fibrous residue remaining after pressing fruits, such as apples or grapes, for juice. Bran represents the outer protective layer of grains, obtained during wheat or rice milling. Oilcake is the high-protein residual meal left after extracting oil from oilseeds. Molasses is the viscous by-product of sugarcane crystallization during sugar refining.

137. (B) Directorate of Marketing and Inspection (DMI)
The Directorate of Marketing and Inspection, an agency under the Ministry of Agriculture and Farmers Welfare, is responsible for implementing the Agricultural Produce Act in India. This agency administers the AGMARK certification scheme, which establishes quality grade standards for raw agricultural commodities to ensure their purity, quality, and grading in the market.

138. (C) Rice bran has active lipase causing rapid rancidity unless stabilized immediately.
Freshly milled rice bran contains highly active endogenous lipase enzymes. Upon milling, these enzymes come into contact with the lipids in the bran, rapidly hydrolyzing triglycerides into free fatty acids. This rapid enzymatic activity causes

oils because they are extracted using low-temperature mechanical pressing. They bypass the high-temperature refining steps, particularly deodorization, which uses steam distillation under vacuum to strip away volatile flavor compounds. This mild extraction process preserves the natural sensory attributes of the seeds.

80. (C) Fully hydrogenated oil – Very low melting point, liquid at room temperature
Fully hydrogenated oil is a solid fat at room temperature characterized by an exceptionally high melting point. This physical state is due to the complete saturation of all double bonds in the fatty acid chains, converting unsaturated liquid oils into fully saturated solid stearin. It does not remain liquid at room temperature.

81. (D) A hydrogenated refined vegetable oil structured to mimic ghee.
In India, Vanaspati is legally defined as a hydrogenated, refined vegetable oil formulated to mimic the physical texture, graininess, and melting characteristics of traditional dairy ghee. It is produced by partially or fully hydrogenating edible vegetable oils, and is historically fortified with Vitamins A and D to enhance its nutritional profile for consumers.

82. (A) I, II, and III
The formation of trans isomers during hydrogenation is promoted by specific process conditions. High reaction temperatures, high catalyst concentrations, and low hydrogen pressure limit the availability of hydrogen at the catalyst surface. This limitation increases the likelihood of double-bond rotation and isomerization over direct saturation, resulting in higher levels of trans fatty acids.

83. (B) It hydrogenates highly unsaturated fatty acids before less unsaturated ones.
Selective hydrogenation is a process designed to preferentially target and hydrogenate highly unsaturated fatty acids, such as linolenic acid, before saturating less unsaturated ones like oleic acid. This targeted reaction improves the oxidative stability of the oil by reducing highly reactive tri-unsaturated fats without completely converting the oil into a solid, saturated fat.

84. (A) Both Statement I and Statement II are true.
Cold pressing extracts vegetable oil using mechanical pressure while maintaining temperatures strictly below fifty degrees Celsius to preserve heat-sensitive nutrients. In contrast, standard expeller pressing involves high-pressure friction that generates significant heat, often exceeding eighty degrees. This thermal stress can degrade sensitive bioactive compounds, antioxidants, and natural volatile aromas in the oil.

85. (A) They have significantly higher levels of trans fatty acids.
Cold-pressed vegetable oils are extracted at low temperatures without chemical refining or partial hydrogenation. Consequently, they do not contain elevated levels of trans fatty acids. They are characterized by retaining natural antioxidants like tocopherols, along with higher levels of free fatty acids and plant pigments, compared to highly processed refined oils.

86. (C) Chemical or enzymatic interesterification
Interesterification is a highly viable chemical or enzymatic technology used to produce zero-trans baking fats. This process rearranges fatty acids within and between triglycerides without affecting the degree of unsaturation. It modifies the physical properties and melting profile of fat blends, providing the desired functionality without forming harmful trans fatty acids.

87. (A) Trans fats are entirely synthetic and are never found in naturally occurring foods like dairy or meat.
Trans fats are not exclusively synthetic, as small amounts occur naturally in dairy and meat from ruminant animals. These natural trans fats, such as vaccenic acid, are formed by biohydrogenation by microbes in the animal's rumen. However, the majority of dietary trans fats originate from industrial partial hydrogenation of vegetable oils.

88. (D) Partial hydrogenation
Partial hydrogenation is the process that yields high levels of trans fatty acids as a side reaction. If a batch of Vanaspati contains forty-five percent trans fat, the manufacturer used partial hydrogenation to achieve the desired solid consistency. This contradicts the "Zero Trans Fat" label, which requires alternative technologies like interesterification or blending.

Click Here to Buy book on Amazon

solvent extraction is far more efficient in terms of oil recovery, leaving less than one percent residual oil in the processed meal. Mechanical pressing alone is less efficient, typically leaving six to eight percent residual oil in the press cake.

70. (A) 2, 4, 3, 1
The chemical refining of crude vegetable oil follows a precise sequential order of unit operations. The process begins with degumming to remove gums, followed by neutralization with alkali to eliminate free fatty acids. The neutralized oil then undergoes bleaching to remove pigments, and finally, deodorization to strip away volatile odoriferous compounds, producing refined edible oil.

71. (A) Physical refining via steam deacidification
Crude rice bran oil with an exceptionally high free fatty acid content is best processed using physical refining. Traditional chemical neutralization with alkali on such oil results in high neutral oil losses due to soap formation and oil entrapment. Physical refining uses steam deacidification under vacuum to distill off free fatty acids, maximizing refined oil recovery.

72. (D) It is a crucial step in the production of solid fats like Vanaspati.
Winterization is a process used to produce clear liquid oils, not solid fats like Vanaspati. It involves cooling the oil slowly to crystallize high-melting-point saturated triglycerides and waxes, which are then filtered out. This treatment ensures that the oil remains clear and free from cloudiness when stored at low refrigerator temperatures.

73. (B) The desolventizer-toaster system
If refined soybean oil contains high residual solvent levels, the desolventizer-toaster system is likely malfunctioning. This equipment is specifically designed to apply steam and heat to the extracted meal and miscella, evaporating and recovering the volatile hexane solvent. Failure in this system prevents complete solvent removal, resulting in unsafe chemical residues in the final products.

74. (C) Flaking rolls – Rupturing cells to increase surface area for extraction
Flaking rolls are essential mechanical devices used in oilseed processing to press prepared seeds into thin flakes. This mechanical action ruptures the internal plant cell walls and increases the overall surface area, facilitating rapid and highly efficient oil extraction during subsequent solvent processes. Other equipment, like expellers, are used for direct mechanical oil expression.

75. (D) Maintaining a high vacuum (low pressure) during the process
During the bleaching of vegetable oils, maintaining a high vacuum is critical to protect the oil from heat-induced damage. The vacuum environment excludes oxygen, preventing thermal oxidation, polymerization, and the isomerisation of unsaturated fatty acids at the elevated temperatures required for optimal clay absorption. This process design ensures the stability and quality of the bleached oil.

76. (A) P-II, Q-I, R-III, S-IV
Hydrogenation adds hydrogen across the double bonds of unsaturated fatty acids to increase melting points. Interesterification rearranges fatty acids on the glycerol backbone to modify fat melting profiles. Fractionation separates liquid and solid fat phases through controlled cooling and crystallization. Winterization removes trace waxes and high-melting fats to prevent cloudiness in refrigerated oils.

77. (B) Nickel
The industrial hydrogenation of edible oils predominantly utilizes nickel as the heterogeneous catalyst. Nickel is highly preferred due to its high catalytic activity, selectivity for unsaturated carbon bonds, and cost-effectiveness compared to precious metals like platinum or palladium. After the reaction, the finely divided nickel catalyst is completely filtered out of the hydrogenated fat.

78. (B) Trans fatty acids are geometric isomers formed as a side reaction during partial hydrogenation.
Trans fatty acids are geometric isomers of unsaturated fats that form during partial hydrogenation of vegetable oils. The hydrogen-catalyst interaction can cause double bonds to temporarily open and rotate before closing, converting the natural cis configuration to the more thermodynamically stable trans form. These trans fats pose significant health risks, particularly regarding cardiovascular diseases.

79. (A) Both A and R are true and R is the correct explanation of A.
Cold-pressed oils possess a much stronger natural aroma and flavor compared to refined

NODIA

99. (D) A is false but R is true.
High-acid foods do not require severe thermal processing like retorting at one hundred twenty-one degrees. Because Clostridium botulinum spores cannot germinate or grow in environments with a pH below four point six, mild pasteurization below one hundred degrees is sufficient to ensure microbiological safety, while severe heat would degrade fruit quality.

100. (A) 5, 2, 4, 3, 1
Canning peach halves begins with sorting and grading to select high-quality fruit. The peaches then undergo lye peeling and thorough washing to remove the skin. Next, they are filled into cans with syrup, exhausted to remove air, sealed, and finally retorted to achieve commercial sterility and ensure a long shelf life.

101. (A) Low O_2 (2-5%) and High CO_2 (5-10%) atmosphere with ascorbic acid and calcium dip
To preserve fresh-cut apple slices, combining chemical dipping with Modified Atmosphere Packaging is highly effective. Dipping in ascorbic acid and calcium chloride prevents enzymatic browning and maintains cell wall crispness. Packaging the slices in an atmosphere of low oxygen and elevated carbon dioxide slows down respiration, delaying physiological deterioration during storage.

102. (C) Higher D-values indicate that the microorganism is highly susceptible to heat.
The D-value represents the time required to reduce a microbial population by ninety percent at a specific temperature. A higher D-value indicates that the microorganism is highly heat-resistant and requires a longer thermal treatment for inactivation, not that it is highly susceptible. Susceptible organisms have low D-values, reflecting rapid destruction.

103. (A) Spoilage by acid-tolerant yeasts producing carbon dioxide gas
The development of hard swell in canned acidic mango pulp is typically caused by acid-tolerant spoilage yeasts. These microorganisms can survive inadequate pasteurization and ferment sugars present in the pulp, producing carbon dioxide gas. This gas accumulation creates high internal pressure, causing the metal can to swell significantly and distort.

104. (D) Flash steam peeling – Tomatoes and root vegetables
Flash steam peeling is an efficient commercial method used for skin removal in tomatoes and root vegetables. This technique exposes the produce to high-pressure steam for a brief period, rapidly cooking the thin layer of cells directly beneath the skin. The sudden release of pressure causes the skin to crack and slip off easily.

105. (B) $85^{\circ}C - 90^{\circ}C$ for 30 to 60 seconds
For pasteurizing fresh mango juice, a thermal treatment of eighty-five to ninety degrees Celsius for thirty to sixty seconds is highly appropriate. This process is sufficient to inactivate spoilage enzymes, such as pectin methylesterase, and destroy vegetative pathogens. This mild heat treatment preserves the delicate natural flavor, color, and nutritional quality of the juice.

106. (A) P-II, Q-I, R-III, S-IV
Spray drying converts liquid fruit juices into instant soluble powders. Freeze drying is a low-temperature sublimation process used for high-value, heat-sensitive products like strawberry pieces. Tunnel drying involves passing sliced vegetables on trays through a drying tunnel. Drum drying is applied to slurries or purees to produce fruit leathers or potato flakes.

107. (D) Peroxidase
Peroxidase is one of the most heat-stable enzymes found in plant tissues. Because of its high thermal resistance, it serves as a reliable indicator enzyme to evaluate the adequacy of blanching in vegetables. If peroxidase is completely inactivated, other quality-degrading enzymes, such as catalase and lipoxygenase, are assumed to be destroyed as well.

108. (A) IQF prevents individual pieces from clumping into a solid block.
Individually Quick Frozen technology is designed to freeze particulate food products rapidly. This rapid freezing prevents individual pieces, such as peas or berries, from sticking or clumping together into a single solid block. It allows consumers to easily pour out the exact quantity needed from the package while maintaining high product quality.

Downloaded from www.pdf.tube

50. (C) Gossypol – Soybeans
Gossypol is a toxic polyphenolic pigment found naturally in cottonseeds, not in soybeans. Soybeans contain different anti-nutritional factors, primarily trypsin inhibitors, lectins, and phytic acid. Khesari dhal contains the neurotoxin BOAA, fava beans contain vicine and convicine which cause favism, and lima beans contain cyanogenic glycosides that release hydrogen cyanide upon hydrolysis.

51. (B) A purified extract containing at least 90% protein on a moisture-free basis.
A legume protein isolate is a highly purified ingredient manufactured by extracting proteins from defatted legume flour and removing non-protein components. It is standardized to contain at least ninety percent protein on a dry weight basis. This distinguished refined product is virtually free from dietary fibers, lipids, insoluble carbohydrates, and anti-nutritional factors.

52. (A) I, II, III, IV
The industrial production of soy protein isolate begins with extracting proteins from defatted flakes using dilute alkali. Centrifugation is then performed to separate the soluble proteins from insoluble fibers. Next, the pH is adjusted to the isoelectric point to precipitate the proteins as a curd, which is washed, neutralized, and spray dried.

53. (A) Consumption of Khesari dhal containing the active neurotoxin BOAA.
Lathyrism is a crippling neurological disorder characterized by spastic paralysis of the lower limbs. It is directly caused by the prolonged consumption of Khesari dhal, which contains the neurotoxic amino acid BOAA. This non-protein amino acid acts as an agonist for glutamate receptors in the central nervous system, leading to upper motor neuron damage.

54. (A) Both Statement I and Statement II are true.
Haemagglutinins are toxic proteins that agglutinate red blood cells and damage the intestinal lining. They are highly resistant to dry heat processing, which fails to neutralize their activity. However, prior soaking followed by thorough boiling in water completely denatures these proteins, rendering them inactive and ensuring the safety of cooked pulses.

55. (A) Dry roasting
Raffinose and stachyose are flatulence-causing oligosaccharides that lack human digestive enzymes for breakdown. Dry roasting is ineffective at reducing these compounds because they are highly heat-stable in dry environments. Conversely, soaking and discarding the water, germination, and fermentation significantly reduce these sugars through leaching and enzymatic hydrolysis by microbial or endogenous alpha-galactosidases.

56. (D) To wash out soluble sugars and flavors while precipitating the proteins.
During the production of legume protein concentrates, an aqueous alcohol wash is utilized. The alcohol denatures and precipitates the proteins, keeping them insoluble. Simultaneously, it dissolves and extracts soluble sugars, mineral salts, and volatile off-flavor compounds. This extraction process increases the protein concentration to approximately seventy percent while improving taste and functional properties.

57. (B) Protein concentrates are costlier to produce due to multiple pH adjustment steps.
Protein isolates are significantly costlier to produce than protein concentrates. This higher cost is due to the complex processing involved, which requires multiple alkaline extractions, centrifugation steps to remove fiber, and acid-based isoelectric precipitation. In contrast, concentrates are produced through simpler processes, such as acid or alcohol washing of defatted flour, requiring fewer steps.

NODIA

58. (C) Germination followed by mild cooking
To formulate highly digestible infant weaning foods, combining germination with mild cooking is the most effective approach to reduce phytic acid. Sprout development activates endogenous phytase enzymes that break down phytates, releasing bound minerals. Subsequent mild cooking further inactivates heat-sensitive anti-nutrients, resulting in a product with superior nutritional quality and mineral bioavailability.

59. (D) Treatment with α-galactosidase – Oligosaccharides
Treating pulses with the enzyme alpha-galactosidase directly targets and hydrolyzes flatulence-causing oligosaccharides, such as raffinose and stachyose, into simple, digestible sugars. This enzyme-specific treatment is highly effective. Other combinations, like polishing or

cannot retain water, leading to severe drip loss, loss of turgidity, and a mushy physical texture.

119. (A) Maillard browning – High drying temperatures and high reducing sugars
Maillard browning is a non-enzymatic chemical reaction between amino acids and reducing sugars. During food dehydration, this reaction is accelerated by high drying temperatures and low moisture levels. This process results in undesirable dark colors, cooked flavors, and a loss of nutritional value, particularly the essential amino acid lysine, in the dried product.

120. (D) Fluidized beds provide high heat transfer for fast, uniform drying of particulate foods.
Fluidized bed dryers are highly preferred for drying small, particulate foods like green peas. They operate by suspending the food particles in an upward-flowing stream of hot air, which behaves like a boiling liquid. This suspension provides exceptionally high heat and mass transfer rates, ensuring rapid, highly uniform drying and minimizing thermal damage.

121. (A) P-II, Q-I, R-IV, S-III
Turmeric contains curcumin, which is responsible for its characteristic yellow color and bioactive properties. Black pepper contains piperine, which provides its sharp, pungent bite. Clove is rich in eugenol, an essential oil with strong antiseptic and aromatic properties. Chilli contains capsaicin, the lipophilic chemical compound responsible for its hot, burning sensation.

122. (C) Supercritical fluid
Supercritical carbon dioxide is widely used for extracting high-quality essential oils and oleoresins from spices. Above its critical temperature and pressure, carbon dioxide exhibits the density of a liquid and the transport properties of a gas. This supercritical state allows for highly selective, low-temperature extraction, preventing thermal degradation and leaving no toxic residues.

123. (D) Steam sterilisation reduces microbial loads but can cause loss of volatile oils.
Steam sterilization is an effective method for reducing the microbial load on spices. However, exposing the spices to high-temperature steam can volatilize some of the low-boiling-point essential oils. This volatilization can lead to a slight reduction in the characteristic aroma and pungency of the spice, presenting a trade-off between microbiological safety and quality.

124. (A) Both A and R are true and R is the correct explanation of A.
Cryogenic grinding utilizes liquid nitrogen to cool the grinding chamber and the spice to extremely low temperatures. This cooling prevents the heat generated during milling from volatilizing the delicate essential oils. It also keeps high-oil spices from releasing their fat and turning into a sticky paste, resulting in a free-flowing, high-quality powder.

125. (B) Mayonnaise – Thermal retorting at 121°C
Mayonnaise is a delicate oil-in-water emulsion that cannot undergo thermal retorting at one hundred twenty-one degrees. Such high temperatures would break the emulsion, causing phase separation and protein coagulation. Mayonnaise is typically preserved through a combination of low pH, pasteurized eggs, and clean manufacturing practices, rather than high-pressure thermal sterilization.

126. (B) Passing steam through spices to vaporize, condense, and separate volatile oils.
Steam distillation is the primary industrial method for extracting essential oils from spices. The process involves passing pressurized steam through the prepared spice bed to vaporize the volatile oil compounds. The resulting steam-oil vapor mixture is subsequently cooled in a condenser, and the immiscible oil and water layers are separated based on density.

127. (D) I, II, III, and IV
The successful fermentation of pickles requires strict control over several environmental factors. The initial salt concentration must select for lactic acid bacteria while inhibiting pathogenic organisms. The fermentation temperature should be maintained within the optimal range. Additionally, oxygen must be completely excluded to prevent the growth of aerobic film yeasts and molds.

128. (C) Organic solvent extraction dissolves both volatile oils and non-volatile principles.
The extraction of spice oleoresins relies on organic solvent extraction, which dissolves both the volatile essential oils and the non-volatile active compounds. This process differs from steam distillation, which extracts only the volatile

Click Here to Buy book on Amazon

109. (A) Both A and R are true and R is the correct explanation of A.
Sun drying of vegetables causes significant losses of Vitamins A and C due to prolonged environmental exposure. The slow drying rate, combined with direct exposure to atmospheric oxygen and ultraviolet radiation, promotes oxidative and photochemical degradation of these highly sensitive vitamins. This makes sun-dried products nutritionally inferior to those dried using controlled dehydration methods.

110. (B) Tomatoes – Sun drying without pre-treatment for red powder
Tomatoes cannot be sun-dried without pre-treatment to produce high-quality red powder, as this leads to severe browning and nutrient loss. Commercial tomato powder production requires spray drying of paste or controlled dehydration of pre-treated slices to preserve the red lycopene pigment. Other processes, such as IQF freezing of green peas, are standard industrial practices.

111. (A) A defect where rapid surface drying forms a shell trapping moisture inside.
Case hardening is a dehydration defect that occurs when the drying temperature is too high or the humidity is too low. The rapid evaporation of surface water causes the outer layer to dry quickly, forming a hard, impermeable skin. This dry shell traps moisture inside the product, hindering further dehydration and promoting internal spoilage.

112. (D) I, II, III, and IV
The stickiness and overall recovery of spray-dried fruit powders are influenced by several process and material factors. The inlet air temperature, feed concentration, and atomizer speed affect moisture evaporation and particle size. Additionally, the use of carrier agents, like maltodextrin, is essential to raise the glass transition temperature, preventing stickiness during drying.

113. (D) Thermal treatment inactivates enzymes, preventing browning and off-flavors in storage.
Blanching is a brief thermal treatment applied to vegetables before freezing or drying. Its primary objective is the inactivation of quality-degrading enzymes, such as polyphenol oxidase and lipoxygenase. Inactivating these enzymes prevents undesirable enzymatic browning, off-flavor development, and loss of texture during storage, thereby maintaining overall product quality and extending shelf life.

114. (A) Both Statement I and Statement II are true.
In counter-current tunnel dryers, the wet product enters at one end while the hottest and driest air is introduced at the opposite discharge end. This configuration is highly efficient because it maintains a consistent drying driving force. However, exposing nearly dry product to the hottest air increases the risk of thermal damage and scorching.

NODIA

115. (B) Achieving commercial sterility to allow room temperature storage
Blanching is a mild thermal pre-treatment and is not designed to achieve commercial sterility. It cannot eliminate heat-resistant bacterial spores, making blanched vegetables unsafe for room-temperature storage without further processing. The intended effects of blanching include softening tissues for filling, expelling intercellular gases to prevent oxidation, and reducing the initial surface microbial load.

116. (D) Using moisture-vapor proof packaging with minimal headspace
Freezer burn is a defect caused by ice sublimation from the product surface during frozen storage. It results in dry, discolored, and tough tissues. Preventing this defect requires using moisture-vapor proof packaging materials with minimal headspace. This packaging prevents moisture loss to the freezer environment, maintaining the quality of the frozen carrots.

117. (A) It is an excellent method for drying large chunks of fruits and vegetables.
Spray drying is designed exclusively for liquid feeds, slurries, or low-viscosity purees, not for large chunks of fruits and vegetables. The liquid feed must be atomized into a fine mist of droplets to maximize surface area. This limitation means the process is unsuitable for solid foods, which require alternative drying methods like tunnel dehydration.

118. (C) Beans were frozen slowly, letting large ice crystals rupture cell walls.
Slow freezing of green beans results in the formation of large, extracellular ice crystals. These large crystals exert mechanical pressure on the surrounding plant cells, rupturing the cell walls. Upon thawing, the damaged cellular structure

hydrolytic rancidity within hours, requiring immediate thermal or chemical stabilization to make the bran suitable for oil extraction.

139. (A) Both A and R are true and R is the correct explanation of A.
Wheat germ oil is highly valued in the cosmetic and nutritional supplement industries because of its unique chemical composition. It is one of the richest natural sources of tocopherols, which function as powerful biological antioxidants. These compounds protect the oil from rapid oxidative degradation and provide significant skin-conditioning benefits when used in cosmetic formulations.

140. (A) ISO 22000 – Statutory standard for grading fresh fruit in local mandis
ISO 22000 is an international food safety management system standard, not a statutory standard for grading fresh fruit in local wholesale markets. Local grading in India is typically governed by AGMARK or state agricultural marketing boards. ISO 22000 focuses on food safety processes across the supply chain rather than grading individual fresh commodities.

141. (B) Increasing raw commodity economic value and appeal through processing or packaging.
Value addition in agricultural processing refers to increasing the economic value and market appeal of a raw commodity. This is achieved through processing, transformation, or packaging, which converts highly perishable raw crops into stable, consumer-friendly products. Examples include processing fresh tomatoes into paste or milling wheat into branded, fortified flour.

142. (D) I, II, III, and IV
To ensure the quality of refined wheat flour and prevent adulteration, multiple physicochemical parameters are evaluated. The moisture content, total ash, and acid-insoluble ash limits are critical indicators of purity and sand contamination. Additionally, the minimum gluten content is measured to ensure the flour possesses the necessary functional baking properties required by food standards.

143. (A) Its high fiber and calcium content allows its effective use in cattle feed.
The husk or seed coat removed during pulse milling is rich in dietary fiber and essential minerals, particularly calcium. Because of this nutritional profile, the husk is widely utilized as a valuable ingredient in livestock and cattle feed formulations. This application provides a cost-effective method to recycle milling by-products into animal nutrition.

144. (A) Both Statement I and Statement II are true.
Defatted oilseed cakes produced via solvent extraction are excellent sources of plant protein and are used to manufacture high-protein flours for human consumption. To ensure safety, these ingredients must be processed using food-grade hexane and strictly monitored for residual solvent limits, heavy metals, and active anti-nutritional factors before being approved for use.

145. (D) Gluten Index
The gluten index is a quality parameter used exclusively to evaluate the viscoelastic properties of wheat gluten, and is not applicable to edible vegetable oils. Vegetable oils are purely lipid-based and contain no gluten. Standard oil evaluation parameters include the iodine value, saponification value, and refractive index, which determine purity and fatty acid composition.

146. (C) It serves as a source of dietary fiber and retains crumb moisture.
Apple pomace is a fibrous by-product of juice extraction that is rich in pectin and insoluble cellulose. When incorporated into baked products like muffins, it serves as an excellent source of dietary fiber. Its water-binding capacity helps retain crumb moisture, preventing the baked goods from drying out and extending their shelf life.

147. (B) Grading strictly involves the chemical alteration of the food to meet specific standards.
Grading is a physical classification process and does not involve the chemical alteration of food products. It classifies raw commodities into distinct quality categories based on physical parameters like size, shape, color, and freedom from defects. These grades help determine market prices and ensure consumer consistency, while leaving the chemical composition unchanged.

148. (D) Contamination with Aflatoxin B_1, which converts to M_1 in milk.
Aflatoxin contamination of groundnut cake used in dairy feed is a major safety concern. The toxic mold Aspergillus flavus produces Aflatoxin B1 in stored groundnuts. When ingested by dairy cows,

NODIA

(D) Clarifier - Centrifugal separation of final sugar crystals

56. Which of the following is NOT a recognized process step in standard cane sugar refining?
(A) Malting
(B) Affination
(C) Decolorization
(D) Recrystallization

57. Read the following statements and choose the correct option:
Statement I: During sugarcane milling, imbibition water is added to the crushed bagasse to maximize the extraction of residual sucrose.
Statement II: The addition of imbibition water reduces the load on the evaporators because it concentrates the juice.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

58. A sugar technologist observes that false grain (very tiny, unwanted crystals) is forming rapidly during crystallization in the vacuum pan. To correct this utilizing supersaturation concepts, the technologist should:
(A) Increase the vacuum level significantly to lower the boiling temperature.
(B) Add a small amount of water to reduce the level of supersaturation.
(C) Increase the overall steam pressure to boil the massecuite much faster.
(D) Introduce additional fine seed crystals to the boiling pan immediately.

59. A sugar factory reports an unusually high volume of final molasses with an abnormally high purity (high residual sucrose). What processing failure does this most likely indicate?
(A) Poor exhaustion and crystal control in the boiling house.
(B) Excessive mechanical washing of the cane stalks before milling.
(C) Over-application of premium decolorizing agents in the refinery.
(D) Maintaining too low a temperature during the milling process.

60. What is the consequence of allowing the pH of sugarcane juice to drop below 5.5 during the heating and evaporation stages?
(A) The juice will undergo spontaneous crystallization inside the multiple-effect evaporators.
(B) The overall color of the processed juice will turn exceptionally bright and white.
(C) Acid-catalyzed inversion of sucrose occurs, reducing the final sugar yield.
(D) The calcium salts used in clarification will completely precipitate out of the solution.

61. What is the standard definition of "Khandsari" in traditional Indian sugar processing?
(A) Liquid jaggery containing extremely high concentrations of inverted simple sugars.
(B) A fully solid block of pure, highly recrystallized and refined white sugar.
(C) Fermented sugarcane juice specifically utilized for alcoholic beverage production.
(D) Semi-refined sugar produced via open-pan evaporation and centrifugal separation.

62. Consider the following statements regarding the quality parameters and grading of honey:
1. The moisture content of honey should generally not exceed 20%.
2. Hydroxymethylfurfural (HMF) is an indicator of freshness; high HMF indicates overheating or prolonged storage.
3. Honey is primarily composed of sucrose, with very little glucose and fructose.
4. Fiehe's test is utilized to detect the presence of invert sugar adulteration in honey.

Which of the statements given above are correct?
(A) 1, 3, and 4
(B) 2, 3, and 4
(C) 1, 2, and 4
(D) 1, 2, and 3

63. Which natural clarifying agent is traditionally used in the preparation of Jaggery to remove impurities (scum) from the boiling juice?
(A) Granular activated charcoal powder
(B) Vegetative mucilage from plant roots
(C) Purified calcium hypochlorite powder
(D) Direct sulfur dioxide gas treatment

64. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): High levels of Hydroxymethylfurfural (HMF) in honey are considered undesirable and may lead to rejection by quality control.

Downloaded from www.pdf.tube

CHAPTER 15

Processing of Beverages, Sugar, Jaggery and Confectionery

1. Which of the following best defines "Black Tea" in terms of its manufacturing process?
(A) Tea leaves that undergo full enzymatic oxidation of catechins before drying.
(B) Tea leaves that are steamed immediately after plucking to prevent enzymatic oxidation.
(C) Tea leaves that are partially fermented to achieve a balance of green and black tea characteristics.
(D) Tea buds that are merely withered and dried without any rolling or oxidation.

2. Consider the following statements regarding the processing steps of orthodox black tea:
1. Withering reduces the moisture content of tea leaves to make them flaccid.
2. Rolling initiates the enzymatic oxidation by rupturing cell walls.
3. Fermentation is conducted at elevated temperatures above 60°C to maximize oxidation.
4. Firing or drying halts enzymatic activity and reduces moisture to around 3%.

Which of the statements given above are correct?
(A) 2, 3, and 4
(B) 1, 3, and 4
(C) 1, 2, and 4
(D) 1, 2, and 3

3. Which specific enzyme is primarily responsible for the biochemical oxidation of catechins during the fermentation step of tea processing?
(A) Polyphenol oxidase
(B) Pectin methylesterase
(C) Lipoxygenase
(D) Amyloglucosidase

4. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Oolong tea exhibits sensory characteristics that fall between those of green and black tea.
Reason (R): Oolong tea is subjected to partial enzymatic oxidation before the drying process halts the enzyme activity.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

5. Which of the following statements is correct regarding tea quality parameters?
(A) Thearubigins are solely responsible for the physical viscosity and primary flavor profile of black tea.
(B) Theaflavins contribute primarily to the bright golden color and brisk taste of the tea liquor.
(C) High concentrations of unoxidized catechins are highly desirable in premium grades of black tea.
(D) The overall ratio of theaflavins to thearubigins has no measurable impact on the final tea quality.

6. Match the type of tea in List I with its primary processing characteristic in List II:
List I: (Tea Type)
P. Green Tea
Q. Black Tea
R. Oolong Tea
S. White Tea
List II: (Processing Characteristic)
I. Partial oxidation
II. Minimal processing, mostly air-dried
III. Complete oxidation
IV. Enzyme inactivation by steaming or panning
(A) P-III, Q-IV, R-II, S-I
(B) P-IV, Q-I, R-III, S-II
(C) P-IV, Q-III, R-I, S-II
(D) P-II, Q-III, R-I, S-IV

NODIA

7. Which of the following statements about tea processing is incorrect?
(A) The CTC (Crush, Tear, Curl) method produces tea that yields a stronger and faster brew than orthodox rolling.
(B) Green tea processing completely omits the fermentation step.
(C) The drying step in tea processing typically involves inlet air temperatures between 90°C and 120°C.
(D) White tea undergoes the most rigorous rolling and cutting processes among all tea types.

8. Arrange the standard processing steps for manufacturing black tea in the correct sequential order:
1. Rolling
2. Drying (Firing)
3. Withering
4. Fermentation (Oxidation)

(A) 3-1-4-2
(B) 1-3-4-2
(C) 3-4-1-2
(D) 1-4-3-2

9. Which of the following is correctly paired regarding tea quality compounds and their primary sensory contribution?
(A) Catechins - Intense astringency and deep red color
(B) Theaflavins - Liquid briskness and golden color
(C) Thearubigins - Distinct and complex floral aroma
(D) Caffeine - Subtle notes of sweetness and body

10. Which of the following pairs of tea processing terminology and its description is incorrectly matched?
(A) Plucking - Harvesting the terminal bud and top two leaves
(B) Fermentation - Anaerobic microbial degradation of leaf sugars
(C) Withering - Moisture loss and chemical changes in leaves
(D) Firing - Thermal inactivation of enzymes and moisture reduction

11. Which of the following compounds is NOT typically considered a primary parameter for evaluating black tea liquor quality?
(A) Anthocyanins
(B) Theaflavins
(C) Thearubigins
(D) Unoxidized catechins

12. Read the following statements and choose the correct option:
Statement I: Green tea contains higher levels of epigallocatechin gallate (EGCG) compared to black tea.
Statement II: The fermentation step in black tea processing converts most catechins into complex polyphenols.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

13. A tea manufacturer wants to produce a tea with high antioxidant properties and zero enzymatic browning. Which processing technique should be applied immediately after harvesting?
(A) Extended withering for 24 hours under shade
(B) Intense mechanical disruption using CTC machines
(C) Prolonged aerobic fermentation in a humidified room
(D) Rapid steaming or pan-firing of the fresh leaves

14. A Food Safety Officer inspecting a tea manufacturing facility notices that a batch of black tea liquor is unusually flat, lacks briskness, and is overly dark. Based on biochemical principles, what is the most likely cause?
(A) Under-fermentation occurred, which left behind a high amount of unoxidized catechins.
(B) The critical withering step was entirely omitted from the standard processing sequence.
(C) Over-fermentation converted most of the bright theaflavins into duller thearubigins.
(D) Excessive moisture was retained because the drying temperature was set too low.

15. What is the primary effect of an excessively high firing temperature (above 130°C) during the final stage of black tea processing?
(A) It significantly increases the briskness of the tea liquor.
(B) It leads to case-hardening and a burnt or smoky off-flavor.

Click Here to Buy book on Amazon

(C) It promotes the formation of desirable volatile flavor compounds.
(D) It reverses the oxidation of catechins back to their original state.

16. In the context of coffee processing, which of the following accurately defines "Wet Processing"?
(A) Drying the whole coffee cherry in the sun before removing the outer husk and pulp mechanically.
(B) Heating and roasting the green coffee beans with high-pressure steam rather than using hot dry air.
(C) Soaking previously roasted coffee beans in water to dissolve and extract all soluble components.
(D) Pulping the cherry and fermenting the sticky mucilage layer before drying the parchment beans.

17. Consider the following statements regarding coffee processing and quality:
1. Dry processing typically produces coffee with heavier body and lower acidity compared to wet processing.
2. The "Stinker" bean defect is caused by over-fermentation during the wet process.
3. Arabica coffee generally possesses higher caffeine content than Robusta coffee.
4. The first crack during roasting indicates the release of steam and the expansion of the bean.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 2, and 3
(C) 2, 3, and 4
(D) 1, 3, and 4

18. Which crucial chemical reaction is primarily responsible for the development of color, aroma, and flavor in coffee beans during roasting?
(A) Caramelization
(B) Enzymatic browning
(C) Maillard reaction
(D) Lipid auto-oxidation

19. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): High-altitude Arabica coffees processed via the wet method generally exhibit brighter acidity in the cup.
Reason (R): Wet processing eliminates the mucilage rapidly, preventing heavy fruit flavors from masking the intrinsic acidic profile of high-grown beans.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

20. Which of the following statements about coffee grinding is correct?
(A) Finer coffee grounds have a smaller surface area, leading to slower extraction.
(B) Espresso extraction requires a coarse grind to allow water to pass rapidly at high pressure.
(C) The grinding process does not significantly affect the rate of flavor staling in roasted coffee.
(D) A burr grinder produces a more uniform particle size distribution compared to a blade grinder.

21. Match the coffee bean defect in List I with its primary cause in List II:
List I: (Coffee Bean Defect)
P. Black bean
Q. Sour bean
R. Stinker bean
S. Quaker bean
List II: (Primary Cause)
I. Unripe coffee cherry lacking sufficient sugars for roasting
II. Over-fermentation producing aliphatic acids
III. Dead or diseased bean before harvesting
IV. Prolonged contact with dirty water during pulping
(A) P-I, Q-II, R-III, S-IV
(B) P-III, Q-II, R-IV, S-I
(C) P-III, Q-IV, R-I, S-II
(D) P-IV, Q-I, R-II, S-III

22. Which of the following statements regarding coffee quality attributes is incorrect?
(A) "Acidity" in coffee tasting refers to a desirable bright, tangy, or fruity sensation, not actual pH level.
(B) "Body" describes the tactile weight or viscosity of the coffee on the palate.
(C) Robusta beans are primarily valued for their complex acidity and delicate floral aromas.
(D) Defects like moldy or earthy flavors are often linked to improper drying and storage

NODIA

this toxin is metabolized and excreted into the milk as Aflatoxin M1, which is highly carcinogenic and poses significant health risks to consumers.

149. (A) Jam – Minimum total soluble solids (68% TSS)
According to food standards, the quality and preservation of fruit jam are defined by its soluble solids content. Standard regulations require a minimum of sixty-eight percent total soluble solids to prevent microbial spoilage and ensure proper gel formation. Other parameters, like diastase activity or gluten content, are used for honey and wheat products.

150. (C) Using a lot-numbering system to link raw material testing with dispatched batches.
Implementing a lot-numbering system is essential to ensure robust quality and traceability in grain milling facilities. This system links incoming raw materials, internal quality test records, and specific processing conditions with the final dispatched batches of flour. This linkage allows for rapid tracking and targeted product recalls in the event of quality safety issues.

www.nodia.in

Downloaded from www.pdf.tube

to remove excess proteins.
3. Centrifugation alone is sufficient to achieve optical clarity in apple juice without enzymes.
4. Gelatin can be used in combination with tannins or silica sol to precipitate suspended particles.

Which of the statements given above are correct?
(A) 1, 3, and 4
(B) 2, 3, and 4
(C) 1, 2, and 3
(D) 1, 2, and 4

33. What is the typical temperature range used for the High-Temperature Short-Time (HTST) pasteurization of acidic fruit juices (pH < 4.5)?
(A) 85-95°C for 15-30 seconds
(B) 60-65°C for 30 minutes
(C) 110-120°C for 1-2 seconds
(D) 130-140°C for 3-5 seconds

34. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Carbonation of soft drinks is more efficient when the water is chilled to temperatures near 0°C to 4°C.
Reason (R): According to Henry's Law, the solubility of a gas in a liquid increases as the temperature of the liquid decreases.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

35. Which of the following correctly describes the "post-mix" formulation method in carbonated beverage dispensing?
(A) Carbonated water and concentrated flavored syrup are blended at the point of dispensing.
(B) Water and syrup are mixed in a large batch tank and then carbonated together before packaging.
(C) Sugar is directly dissolved into pre-carbonated water inside the final bottle.
(D) Only natural fruit juices are carbonated without the addition of any concentrated syrups.

36. Match the fruit juice extraction equipment in List I with its most appropriate application in List II:
List I: (Extraction Equipment)
P. Citrus reamer/extractor
Q. Hydraulic press
R. Decanter centrifuge
S. Screw press
List II: (Application)
I. Continuous extraction of grape or apple pulp
II. Separating juice from highly fibrous purees like mango
III. Cold-pressing whole apples in batch processing
IV. Extracting juice without extracting peel oils and bitterness
(A) P-IV, Q-I, R-III, S-II
(B) P-III, Q-IV, R-I, S-II
(C) P-II, Q-III, R-IV, S-I
(D) P-IV, Q-III, R-II, S-I

37. Which of the following statements about fruit juice processing is incorrect?
(A) Deaeration is performed prior to pasteurization to prevent the oxidation of Vitamin C.
(B) Aseptic packaging requires the juice to be filled into unsterilized cartons and then heated.
(C) Homogenization is used in cloudy juices to prevent the separation of suspended pulp.
(D) Flash pasteurization minimizes thermal damage to the sensory and nutritional qualities of the juice.

38. Arrange the standard operational steps for manufacturing carbonated soft drinks in the correct sequence:
1. Carbonation
2. Water treatment and purification
3. Filling and capping
4. Syrup preparation and proportioning
(A) 4-2-1-3
(B) 2-1-4-3
(C) 2-4-1-3
(D) 4-1-2-3

39. Which of the following pairs concerning beverage processing is correctly matched?
(A) Carbonator - Removes dissolved oxygen from treated water
(B) Clarifier - Introduces carbon dioxide gas to the beverage

NODIA

(C) Pasteurizer - Rapidly reduces the size of suspended pulp
(D) Proportioner - Mixes water and syrup in exact ratios

40. Which of the following pairs is incorrectly matched regarding ingredients in carbonated soft drinks?
(A) Saponin - Emulsifier used to prevent flavor ring formation
(B) Phosphoric acid - Acidulant primarily used in cola beverages
(C) Sodium benzoate - Antimicrobial preservative
(D) Aspartame - Artificial sweetener used in diet sodas

41. Which of the following is NOT an established method or principle utilized for carbonating beverages?
(A) In-bottle fermentation (e.g., traditional ginger ale or Champagne)
(B) Boiling the beverage to release endogenous CO_2
(C) Carbonation by sparging under high pressure in a carbonation tank
(D) Inline carbonation using venturi injectors

42. Read the following statements and choose the correct option:
Statement I: The Brix-to-acid ratio is a critical quality parameter used to assess the maturity and flavor balance of citrus fruits for juicing.
Statement II: A higher Brix-to-acid ratio indicates a sourer and less mature fruit.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

43. A fruit juice processor wants to produce clear apple juice but faces rapid enzymatic browning during the crushing phase. Applying the concept of enzyme inhibition, which immediate intervention is most effective?
(A) Adding ascorbic acid to the apple mash during crushing.
(B) Increasing the pH of the mash using sodium hydroxide.
(C) Exposing the crushed apples to oxygen to accelerate color setting.
(D) Storing the crushed mash at room temperature for 12 hours before pressing.

44. A carbonated soft drink bottling plant experiences excessive foaming and "fobbing" during the filling process, resulting in underfilled bottles. What is the most likely technical cause of this issue?
(A) The syrup concentration in the beverage is too low.
(B) The filling machine pressure is maintained slightly above atmospheric pressure.
(C) The temperature of the carbonated beverage during filling is too high.
(D) The water used for the beverage was thoroughly deaerated.

45. What is the direct effect of failing to adequately deaerate fruit juice before subjecting it to thermal pasteurization?
(A) Complete inactivation of naturally occurring pectinase enzymes.
(B) Immediate precipitation of tartrate crystals in the juice paste.
(C) Significant increase in the total soluble solids (Brix) value.
(D) Rapid loss of ascorbic acid and creation of oxidized off-flavors.

46. In sugarcane processing, what does the term "Massecuite" define?
(A) The fibrous cane residue left behind after juice extraction.
(B) The clarified juice prior to entering the evaporation stage.
(C) A dense mixture of sugar crystals and suspended mother liquor.
(D) The milk of lime reagent used during the defecation process.

47. Consider the following statements about sugarcane juice clarification:
1. Defecation involves heating the juice and adding milk of lime to precipitate impurities.
2. Sulfitation involves bubbling sulfur dioxide gas through the limed juice to achieve a bleaching effect.
3. Carbonatation uses high doses of lime followed by carbon dioxide gas to form calcium carbonate precipitates.
4. Clarification primarily aims to increase the moisture content of the juice before crystallization.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 2, and 3

Click Here to Buy book on Amazon

(C) 2, 3, and 4
(D) 1, 3, and 4

48. Which type of equipment is standardly used for the evaporation of clarified sugarcane juice to form a thick syrup?
(A) Single-effect falling film evaporator system
(B) Direct-fired open pan industrial boiling system
(C) Rotary atomizer spray dryer unit
(D) Multiple-effect vacuum evaporator system

49. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Vacuum pans are used for the crystallization of sugar from thick syrup.
Reason (R): Boiling under a vacuum lowers the boiling point of the syrup, which prevents the thermal degradation (caramelization) of sucrose.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

50. Which of the following statements regarding the crystallization of sugar is correct?
(A) Spontaneous crystal formation occurring naturally in highly undersaturated sugar solutions.
(B) Raising the internal boiling temperature continuously to 120°C to trigger nucleation.
(C) Adding fine sugar dust to initiate crystal growth in a supersaturated syrup.
(D) Cooling the hot syrup rapidly to low temperatures without utilizing evaporation.

51. Match the term related to sugar refining in List I with its correct description in List II:
List I: (Sugar Refining Term)
P. Affination
Q. Decolorization
R. Centrifugation
S. Molasses
List II: (Description)
I. Using activated carbon or bone char to remove pigments
II. The dark, viscous by-product from which no more sugar can be economically crystallized
III. Washing raw sugar crystals with a heavy syrup to remove the outer molasses film
IV. Separating sugar crystals from the massecuite
(A) P-III, Q-I, R-IV, S-II
(B) P-I, Q-III, R-II, S-IV
(C) P-III, Q-II, R-IV, S-I
(D) P-IV, Q-I, R-III, S-II

52. Which of the following statements regarding sugar refining operations is incorrect?
(A) Granulated white sugar is produced by redissolving affined raw sugar and subjecting it to further purification.
(B) Ion-exchange resins can be used to remove colorants and inorganic ash components from the sugar liquor.
(C) The final step of refining involves drying the sugar crystals using a rotary granulator (hot air dryer).
(D) Bone char is strictly plant-based and is the only legal decolorant for refined sugar globally.

53. Arrange the fundamental steps of converting sugarcane into raw sugar in the correct sequential order:
1. Juice clarification (Defecation)
2. Juice extraction (Milling)
3. Crystallization in vacuum pans
4. Evaporation to thick syrup
(A) 1-2-4-3
(B) 2-1-4-3
(C) 2-4-1-3
(D) 1-4-2-3

54. Which of the following correctly pairs a sugarcane processing by-product with its primary industrial application?
(A) Filter mud (Press mud) - Direct fermentation in the production of rum
(B) Molasses - Raw material in the manufacture of high-quality paper pulp
(C) Bagasse - Fuel for electricity and steam cogeneration in processing
(D) Bagasse - Direct crystallization and refinement into powdered sugar

55. Which of the following is incorrectly paired regarding the equipment used in sugar processing?
(A) Shredder/Knives - Preparation of cane prior to milling
(B) Roller mills - Extraction of juice from cane fiber
(C) Multiple-effect evaporator - Concentration of juice to syrup

Downloaded from www.pdf.tube

conditions.

23. Arrange the following steps of the wet processing method for coffee in the correct order:
1. Fermentation to remove mucilage
2. Pulping to remove the outer skin
3. Washing
4. Drying the parchment coffee

(A) 1-2-3-4
(B) 2-3-1-4
(C) 1-3-2-4
(D) 2-1-3-4

24. Which of the following pairs regarding coffee quality is correctly matched?
(A) Body - Mouthfeel and heaviness of the brew
(B) Acidity - Physical thickness of the beverage
(C) Aroma - The sensation of residual sweetness
(D) Bitterness - Solely derived from the carbohydrate content

25. Which of the following is an incorrect pair of the stages of coffee roasting?
(A) Light Roast - High acidity, pronounced origin flavors
(B) Dark Roast - Dominant roast notes with higher caffeine content
(C) Medium Roast - Optimal balance of acidity, sweetness, and body
(D) First Crack - Transition from endothermic to exothermic phase

26. Which of the following is NOT recognized as a standard physical defect in green coffee beans?
(A) Insect-damaged bean
(B) Peaberry
(C) Broken/chipped bean
(D) Black bean

27. Read the following statements and choose the correct option:
Statement I: Dry processing of coffee relies on natural sun drying of the whole cherry, which imparts a fruity and full-bodied profile.
Statement II: Mechanical pulpers are unnecessary in the dry processing method because the fruit is dried intact.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

28. A barista notices that a freshly brewed espresso shot extracts in just 10 seconds and tastes extremely sour and weak. How should the barista adjust the coffee parameters based on extraction principles?
(A) Coarsen the grind size to increase the extraction time.
(B) Decrease the water temperature to slow down extraction.
(C) Fine the grind size to lengthen the extraction time.
(D) Reduce the overall coffee dose in the portafilter.

NODIA

29. During a cupping session, a coffee evaluator notes a distinct "medicinal" or "phenolic" off-flavor in a batch of beans. This defect, often known as "Rioy", is primarily a consequence of:
(A) Roasting the coffee beans excessively dark well past the second crack.
(B) Restricting the natural fermentation time during the wet processing phase.
(C) Grinding the roasted coffee beans to an extremely coarse particle size.
(D) Fungal contamination of the coffee cherries during drying on the ground.

30. What is the primary biochemical effect of roasting coffee beans significantly past the "second crack"?
(A) Enhancement of floral and fruity aromatic volatiles.
(B) Preservation of chlorogenic acids and maximum acidity.
(C) Excessive pyrolysis and loss of unique origin flavors.
(D) Complete volatilization and elimination of all caffeine.

31. In the context of soft drink manufacturing, what is the precise definition of "Carbonation"?
(A) The addition of sodium bicarbonate to neutralize the acidity of the beverage.
(B) The process of dissolving carbon dioxide gas in a liquid under pressure.
(C) The thermal degradation of sugars to create caramel coloring for colas.
(D) The filtration of water through activated carbon filters.

32. Consider the following statements regarding the clarification of fruit juices:
1. Pectinase enzymes are added to degrade pectin, preventing haze formation.
2. Bentonite is commonly used as a fining agent

Reason (R): HMF is formed from the breakdown of fructose in the presence of acid and heat, indicating that the honey has been thermally abused or adulterated with heated invert syrup.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

65. Which of the following statements about honey processing is correct?
(A) Gentle warming to 40-50°C to lower viscosity and aid filtration.
(B) Boiling honey at 100°C for 30 minutes to achieve commercial sterility.
(C) Filtration is strictly banned to preserve all natural pollen grains.
(D) Extraction using high-pressure hydraulic presses to squeeze the combs.

66. Match the honey quality defect or parameter in List I with its primary cause or implication in List II:
List I: (Honey Defect/Parameter)
P. High Moisture Content (>20%)
Q. High HMF
R. Granulation/Crystallization
S. Fermentation
List II: (Cause/Implication)
I. Risk of multiplication of osmophilic yeasts
II. Overheating or prolonged storage
III. High glucose-to-water ratio
IV. Extracting unripened honey from unsealed combs
(A) P-I, Q-III, R-II, S-IV
(B) P-IV, Q-I, R-III, S-II
(C) P-IV, Q-II, R-III, S-I
(D) P-II, Q-IV, R-I, S-III

67. Which of the following statements about the Jaggery manufacturing process is incorrect?
(A) Vacuum pans and multiple-effect evaporators are the standard equipment used for rural jaggery production.
(B) Sugarcane juice is boiled in open pans rather than under vacuum.
(C) The temperature of the boiling juice is raised to about 115-120°C to reach the striking point.
(D) Continuous stirring is required during boiling to prevent caramelization and burning at the bottom of the pan.

68. Arrange the typical steps involved in commercial honey processing in the correct order:
1. Centrifugal extraction from uncapped combs
2. Warming (liquefaction)
3. Filtration to remove wax and debris
4. Bottling/Packaging
(A) 2-1-3-4
(B) 1-3-2-4
(C) 3-1-2-4
(D) 1-2-3-4

69. Which of the following pairs regarding honey composition is correctly matched?
(A) Most abundant sugar - Pure sucrose
(B) Most abundant sugar - Natural fructose
(C) Primary organic acid - Concentrated acetic acid
(D) Primary metabolic enzyme - Active lipase

70. Which of the following is incorrectly paired regarding variants of traditional Indian sugar products?
(A) Gur - Fully solidified raw jaggery
(B) Kakvi - Viscous liquid jaggery syrup
(C) Khandsari - Pure refined white sugar
(D) Shakkar - Granular jaggery powder

71. According to general food safety standards, which of the following is NOT permitted as an additive in pure commercial honey?
(A) Trace amounts of naturally occurring pollen
(B) Natural bee enzymes like diastase
(C) Small amounts of natural beeswax fragments
(D) High Fructose Corn Syrup (HFCS)

72. Read the following statements and choose the correct option:
Statement I: Crystallization (granulation) in honey is a natural process and does not indicate spoilage or adulteration.
Statement II: Heating crystallized honey gently in a water bath will return it to a liquid state without significantly degrading its quality.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

73. A honey processor wants to prevent the fermentation of a batch of honey that has a borderline moisture content of 19.5%. What is

Click Here to Buy book on Amazon

the most standard industry practice to mitigate this risk without damaging the honey?
(A) Adding chemical preservatives like sodium benzoate directly to the batch.
(B) Briefly pasteurizing at 70°C to destroy active osmophilic yeasts.
(C) Diluting the honey paste with water to reduce overall sugar levels.
(D) Storing the honey permanently at a elevated temperature of 45°C.

74. A Food Safety Officer analyzes a honey sample and finds that it contains 15% sucrose and exhibits a positive C4 sugar isotope test. What does this indicate?
(A) The honey was harvested too early before the bees could ripen it.
(B) The honey is adulterated with cane sugar or corn syrup.
(C) The honey has been overheated during processing.
(D) The honey was properly processed and is of premium quality.

75. What is the primary adverse effect of packing jaggery with an excessively high moisture content (e.g., >10%)?
(A) It suffers from rapid mold growth and spoilage.
(B) It becomes extremely hard and difficult to chew.
(C) It rapidly loses all organic mineral components.
(D) It turns into a completely white solid mass.

76. In confectionery, what physical state best describes a standard hard-boiled candy?
(A) A highly supersaturated sucrose crystal lattice.
(B) A stable emulsion of fat inside sugar syrup.
(C) An amorphous, non-crystalline glass state.
(D) A hydrocolloid gel network based on pectin.

77. Consider the following statements regarding the tempering of chocolate:
1. Tempering involves controlled heating and cooling of liquid chocolate.
2. The goal is to encourage cocoa butter to crystallize strictly in the unstable Form I and Form II structures.
3. Proper tempering ensures the chocolate has a glossy finish and a crisp snap.
4. Failure to temper properly leads to fat bloom on the surface of the chocolate.

Which of the statements given above are correct?
(A) 1, 2, and 3
(B) 2, 3, and 4
(C) 1, 2, and 4
(D) 1, 3, and 4

78. What is the primary purpose of the "Conching" step in chocolate manufacturing?
(A) To roast the raw cocoa beans thoroughly to develop essential flavor precursors.
(B) To extract pure cocoa butter lipids efficiently from the roasted cocoa mass.
(C) To knead and aerate the mass to reduce moisture, acidity, and particle size.
(D) To cool the liquid tempered chocolate rapidly inside molds to form solid bars.

79. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): In sugar confectionery, doctoring agents such as invert sugar or glucose syrup are added to the formulation of hard-boiled candies.
Reason (R): Doctoring agents lower the solubility of sucrose and rapidly induce complete crystallization of the candy mass.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

80. Which of the following statements regarding the formulation of gummy confections is correct?
(A) Gummies derive their distinct chewy texture from the Maillard browning reaction.
(B) Gummies are classified as high-boiled candies with moisture content under 2%.
(C) The crystallization of sucrose is heavily promoted to provide a crunchy bite.
(D) Gelatin or pectin are added to establish the characteristic chewy gel network.

81. Match the type of confectionery in List I with its defining characteristic or ingredient in List II:
List I: (Confectionery Type)
P. Hard boiled candy
Q. Toffee
R. Gummy
S. Fondant
List II: (Defining Characteristic/Ingredient)

I. Emulsion of sugar syrup, fat, and milk solids cooked to caramelize
II. Amorphous glass state, moisture $< 2\%$
III. Microcrystalline sugar mass dispersed in a saturated syrup
IV. Chewy texture provided by hydrocolloids (e.g., gelatin)
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-IV, R-I, S-III
(D) P-III, Q-I, R-IV, S-II

82. Which of the following statements about toffee manufacturing is incorrect?
(A) Toffee functions as a stable emulsion of fat within a highly concentrated sugar syrup.
(B) Milk proteins are essential for flavor development via Maillard browning during cooking.
(C) Toffee requires complete sugar inversion to form a hard, non-chewy brittle glass.
(D) Emulsifiers like lecithin are commonly added to stabilize the internal fat dispersion.

83. A confectionery manufacturer observes a grayish-white film on the surface of their packaged chocolate bars. How can the manufacturer determine if it is fat bloom rather than sugar bloom?
(A) Fat bloom melts upon gentle rubbing, while sugar bloom dissolves in water.
(B) Sugar bloom melts instantly on touch, whereas fat bloom remains fully solid.
(C) Fat bloom dissolves completely when a single drop of water is placed on it.
(D) Sugar bloom occurs on white chocolate, while fat bloom occurs on dark types.

84. Which of the following is correctly paired regarding chocolate manufacturing processes?
(A) Enrobing - Pumping liquid chocolate into molds to form solid bars
(B) Tempering - Adding sugar and milk powder to the cocoa mass
(C) Fermentation - Developing the final glossy shine on the chocolate
(D) Winnowing - Removing the shell from the roasted cocoa nibs

85. Which of the following is an incorrect pair of a confectionery ingredient and its primary technological role?
(A) Corn syrup - Prevents sucrose crystallization
(B) Invertase - Hardens the center of liquid-filled chocolates
(C) Cocoa butter - Provides the continuous fat phase in chocolate
(D) Gelatin - Provides elastic and chewy texture in gummies

86. Which of the following fats is NOT permitted or suitable to be used as a Cocoa Butter Equivalent (CBE) in chocolate manufacturing?
(A) Solid sal seed fat
(B) Pure illipe butter
(C) Liquid soybean oil
(D) Refined kokum gurgi

87. Read the following statements and choose the correct option:
Statement I: Sugar inversion is the hydrolysis of sucrose into equimolar amounts of glucose and fructose.
Statement II: In hard candy manufacturing, uncontrolled excessive inversion can lead to a sticky product due to the high hygroscopicity of fructose.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

88. Applying principles of physical chemistry, why does liquid melted chocolate suddenly "seize" (become a thick, lumpy paste) if a small amount of water is accidentally introduced?
(A) Water wets sugar crystals, causing them to clump and disrupt the continuous fat phase.
(B) Water dissolves the hydrophobic cocoa butter crystals, instantly breaking the emulsion.
(C) Water acts as a direct chemical catalyst for the rapid oxidation of all cocoa solids.
(D) Water instantly polymerizes milk proteins, converting the fat into a rubbery gel.

89. A chocolatier evaluates a new batch of dark chocolate and notices it has a gritty, sandy mouthfeel instead of being smooth. Based on the chocolate manufacturing process, which step was most likely inadequate?
(A) Seed roasting
(B) Bean refining
(C) Fat tempering
(D) Seed winnowing

Downloaded from www.pdf.tube

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 2, and 3
(C) 2, 3, and 4
(D) 1, 3, and 4

123. Which specific enzyme is frequently added to bread formulations as a functional ingredient to delay staling (crumb firming) by modifying starch structures?
(A) Maltogenic alpha-amylase
(B) Protease enzyme
(C) Lipase enzyme
(D) Ascorbic acid oxidase enzyme

124. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Calcium propionate is widely used as a functional additive in commercially baked bread.
Reason (R): Calcium propionate is an effective antimicrobial agent that specifically inhibits the growth of mold and rope-forming bacteria without significantly affecting yeast activity.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

125. Which of the following statements about quality control in bakery products is correct?
(A) The average moisture level of freshly baked white bread is typically below 10%.
(B) Overall shelf-life of commercial baked goods is solely dependent on fat levels.
(C) Water activity (a_w) in bread is around 0.3, protecting it from mold growth.
(D) A Texture Profile Analyzer (TPA) measures crumb firmness and elasticity.

126. Match the functional enzyme in List I with its primary purpose in bakery products in List II:
List I: (Functional Enzyme)
P. Protease
Q. Hemicellulase / Xylanase
R. Lipoxygenase
S. Alpha-amylase
List II: (Primary Purpose)
I. Breaks down pentosans to improve dough extensibility and crumb softness
II. Bleaches flour pigments and strengthens dough via oxidation
III. Relaxes overly strong gluten, reducing dough mixing time and shrinkage
IV. Hydrolyzes starch to provide fermentable sugars and retard staling
(A) P-I, Q-III, R-IV, S-II
(B) P-IV, Q-II, R-I, S-III
(C) P-III, Q-I, R-II, S-IV
(D) P-III, Q-IV, R-II, S-I

NODIA

127. Which of the following statements regarding quality control parameters for bakery products is incorrect?
(A) High moisture content in bread (approx. 35-40%) necessitates the use of preservatives or strict hygiene to prevent mold.
(B) The specific volume of bread is measured by dividing the loaf's weight by its volume (g/cc).
(C) Biscuits and crackers have very low water activity ($a_w < 0.4$), making them microbiologically stable.
(D) Oxidative rancidity is a major quality defect in bakery products with high fat content, like cookies and pastries.

128. A food technologist evaluates a packaged cake product with a water activity (a_w) of 0.88. Based on competency in food microbiology, which of the following is the most significant shelf-life threat for this product at room temperature?
(A) Clostridium botulinum outgrowth
(B) Spoilage by halophilic bacteria
(C) Rapid enzymatic browning activity
(D) Growth of common spoilage molds

129. Which of the following correctly pairs a functional bakery ingredient with its primary classification?
(A) Ascorbic acid - Dough oxidant
(B) Sodium bicarbonate - Chemical preservative
(C) Calcium propionate - Dough leavening agent
(D) DATEM - Anti-caking food stabilizer

130. Which of the following is an incorrect pair regarding bakery ingredients and their effects?
(A) Glycerol monostearate - Emulsifying crumb softener and anti-staling agent
(B) L-Cysteine - Functional reducing agent and structural dough relaxer
(C) Potassium bromate - Legal bleaching agent under food safety regulations
(D) Vital wheat gluten - Added to weaker flours

98. A baker assesses the readiness of kneaded bread dough by gently stretching a small piece until it forms a thin, translucent membrane without tearing. What is this standard competency test called?
(A) The Falling Number test
(B) The Pelshenke test
(C) The Windowpane test
(D) The Extensograph test

99. Which of the following incorrectly pairs a wheat protein with its primary rheological contribution to dough?
(A) Globulin - Structural gas-holding network backbone
(B) Gliadin - Flour extensibility and stretching ability
(C) Glutenin - Dough elasticity and shape recovery power
(D) Gluten complex - Structural visco-elastic traits

100. Which of the following pairs regarding bread making methods is incorrect?
(A) Straight dough method - All ingredients are mixed in a single step
(B) Sponge and dough method - A portion of flour, water, and yeast is fermented first, then mixed with the rest of the ingredients
(C) Sourdough method - Utilizes wild yeast and lactic acid bacteria for fermentation
(D) Chorleywood Bread Process (CBP) - Relies on prolonged bulk fermentation (4-6 hours) instead of mechanical development

101. Which of the following is NOT a functional role of sugar (sucrose) in a standard bread formulation?
(A) Providing a rapidly fermentable carbon source for Yeast activity.
(B) Strengthening the gluten network via disulfide bonds.
(C) Enhancing crust color through Maillard and caramelization.
(D) Retaining moisture in the crumb to improve overall shelf-life.

102. Read the following statements and choose the correct option:
Statement I: The staling of bread is primarily caused by the loss of moisture to the surrounding environment.
Statement II: The most significant factor in bread staling is the retrogradation of starch, specifically the re-crystallization of amylopectin.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

103. Applying concepts of flour functionality: If a bakery substitutes a standard bread flour (11% protein) with a high-gluten flour (14% protein) in a recipe, what primary adjustment must be made to the formulation to achieve optimal dough consistency?
(A) Decrease the amount of yeast significantly.
(B) Eliminate all fat from the recipe.
(C) Decrease the baking temperature by 20°C.
(D) Increase the amount of hydration (water).

104. A bakery produces a batch of bread that collapses slightly in the oven and has a coarse crumb with massive, uneven air pockets. What was the most likely error in the process?
(A) Over-proofing caused the gluten network to rupture.
(B) The bread dough was severely and extremely under-proofed.
(C) The baking oven temperature was programmed far too high.
(D) Excessive sodium chloride was added to the formulation.

105. What is the cause-and-effect relationship regarding the use of steam injection in the oven during the first few minutes of baking crusty breads (like baguettes)?
(A) Dries the surface rapidly → creates a thick crust → restricts the overall oven spring.
(B) Moistens surface → allows maximum oven spring → gelatinizes starch for crisp crust.
(C) Kills yeast instantly → blocks dough expansion → produces an excessively dense crumb.
(D) Lowers oven temperature → prolongs baking time → prevents surface Maillard browning.

106. In cake and biscuit manufacturing, what does the "creaming method" specifically refer to?
(A) Folding whipped heavy dairy cream directly into a lean sponge cake batter.
(B) Mixing solid fat and sugar to entrap air before adding liquid ingredients.
(C) Blending dry non-dairy creamer into flour to improve final crumb whiteness.
(D) Melting butter and folding it into a pre-

Click Here to Buy book on Amazon

139. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Hops are added to the boiling wort during beer production.
Reason (R): Hops impart characteristic bitterness to balance the sweetness of the malt, contribute aromatic compounds, and possess natural antimicrobial properties.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

140. Which of the following statements about the malting process is correct?
(A) Roasting raw, dry barley seeds until they transform into a dark, insoluble powder.
(B) Adding active brewing yeast to grain mixtures to initiate ethanol fermentation.
(C) Steeping, germinating, and kilning barley to develop starch-degrading enzymes.
(D) Inactivating unwanted structural enzymes like starch-destroying alpha-amylase.

141. Match the alcoholic beverage in List I with its traditional primary raw material in List II:
List I: (Alcoholic Beverage)
P. Rum
Q. Bourbon Whiskey
R. Brandy
S. Tequila
List II: (Primary Raw Material)
I. Fermented fruit juice (typically grape)
II. Blue Agave plant
III. Sugarcane molasses or juice
IV. Corn (at least 51%)
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-I, R-IV, S-II
(C) P-I, Q-IV, R-III, S-II
(D) P-III, Q-IV, R-I, S-II

142. Which of the following statements regarding quality defects and adulterants in beverages is incorrect?
(A) Methanol adulteration in illicit spirits is highly toxic and can cause blindness or death due to its metabolism into formic acid.
(B) Brominated Vegetable Oil (BVO) has historically been used in citrus soft drinks but is restricted or banned in many regions due to toxicity.
(C) Argemone oil is a common, legal clarifying agent used in premium wines.
(D) Chicory is often blended with coffee, which is legally permitted if declared, but considered an adulterant if undeclared.

143. A Food Safety Officer is tasked with checking for dangerous adulterants in local illicit liquors (country liquor). Which chemical contaminant is the most critical target for rapid screening due to its severe acute toxicity (causing optic nerve damage)?
(A) Ethanol
(B) Methanol
(C) Isoamyl alcohol
(D) Ethyl acetate

144. Which of the following correctly pairs a beverage defect with its specific cause?
(A) Chill haze in beer - Excessive hop bitterness
(B) Skunky beer (Lightstruck) - Oxidation of ethanol to acetic acid
(C) Ropiness in cider - Presence of diacetyl
(D) Cork taint in wine - 2,4,6-Trichloroanisole (TCA)

NODIA

145. Which of the following is incorrectly paired regarding common off-flavors in beer and their typical source?
(A) Isoamyl acetate - Cardboard or wet paper flavor, from severe oxidation
(B) Diacetyl - Buttery flavor, often from yeast or Pediococcus contamination
(C) Dimethyl sulfide (DMS) - Cooked corn or cabbage flavor, from malt precursors
(D) Acetic acid - Vinegar sourness, from Acetobacter spoilage

146. Which of the following is NOT a distilled spirit?
(A) Gin
(B) Vodka
(C) Mead
(D) Rum

147. Read the following statements and choose the correct option:
Statement I: Red wine production typically involves fermenting the must at a higher temperature than white wine production.
Statement II: The higher fermentation temperature in red wine assists in the optimal extraction of color and tannins from the grape

114. Which of the following pairs is correctly matched regarding cake production?
(A) Mechanical aeration - Adding baking soda and dry acid to the mixture
(B) High-ratio cake - Formulating with more flour than sugar by weight
(C) Emulsification - Disperses fat and water uniformly in the cake batter
(D) Lamination - Vigorously creaming butter and sugar until fully aerated

115. Which of the following is an incorrect pair of a baking zone of a tunnel oven for biscuits?
(A) Zone 4 (Gelatinization) - Maximum swelling of starches post-baking
(B) Zone 1 (Development) - Rapid heating, dough expansion, and gas release
(C) Zone 2 (Drying) - Extensive moisture removal and crumb structure setting
(D) Zone 3 (Coloring) - Maillard browning and caramelization of the surface

116. Which of the following is NOT a recognized method of achieving aeration in bakery products?
(A) Biological (yeast fermentation)
(B) Chemical (baking powder)
(C) Mechanical (whipping/creaming)
(D) Magnetic (induction raising)

117. Read the following statements and choose the correct option:
Statement I: In short dough biscuits, gluten development is intentionally minimized to ensure a tender, crumbly texture.
Statement II: High levels of fat and sugar act as tenderizers by coating the flour particles and restricting water absorption by gluten proteins.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

118. A baker formulates a sponge cake but finds that the foam collapses when the melted butter is folded in, resulting in a dense cake. Based on the physical properties of foams, how can this be prevented?
(A) By folding the liquid fat in extremely vigorously for a very long duration.
(B) By raising the baking oven temperature to a high level of around 250°C.
(C) By stabilizing the foam with sugar and folding fat gently to preserve air cells.
(D) By replacing all of the high-protein egg white liquids with plain water.

119. A biscuit manufacturer evaluates a batch of "Marie" style hard-sweet biscuits and finds them unacceptably hard and tough, with a shrunken shape. What process deviation most likely caused this?
(A) Mixing the biscuit dough for too short a time, failing to form gluten.
(B) Adding an excessive amount of shortening fat directly to the formula.
(C) Reducing the commercial baking time in the tunnel oven too drastically.
(D) Over-mixing and excessive scrap reuse leading to over-developed gluten.

120. What is the cause-and-effect relationship regarding sugar granulation in cookie dough?
(A) Coarse sugar → slow dissolution → late syrup volume increase → excessive spread.
(B) Powdered sugar → instant dissolution → minimal syrup spread → spherical shapes.
(C) Invert syrup → rapid crystallization in the baking oven → very hard texture.
(D) Coarse sugar → total prevention of gluten network formation → weak dough.

121. In bakery science, how is a "Dough Improver" best defined?
(A) A dark coloring agent added to make whole wheat bread dough appear darker.
(B) A mix of enzymes, emulsifiers, and oxidants that improves dough performance.
(C) A synthetic chemical compound used to artificially flavor sourdough breads.
(D) A preservative that prevents staling without altering dough mechanics.

NODIA

122. Consider the following statements regarding functional emulsifiers in bakery products:
1. Sodium Stearoyl Lactylate (SSL) functions both as a dough strengthener and a crumb softener.
2. Diacetyl Tartaric Acid Esters of Mono- and Diglycerides (DATEM) are excellent dough strengtheners, particularly useful in crusty breads and frozen doughs.
3. Lecithin is a natural emulsifier commonly derived from soybeans used to improve fat dispersion.
4. Emulsifiers act primarily by accelerating yeast fermentation.

whipped egg and sugar foam structure.

107. Consider the following statements regarding biscuit and cookie manufacturing:
1. Hard sweet biscuits (like Marie) require extensive gluten development to create a cohesive dough that can be sheeted.
2. Short dough biscuits (like shortbread) rely on high fat and sugar content to inhibit gluten formation, resulting in a crumbly texture.
3. Biscuits are typically baked at very low temperatures (100°C) for several hours to slowly dry them out.
4. Ammonium bicarbonate is frequently used as a chemical leavening agent in low-moisture biscuits.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

108. Which chemical leavening agent is widely favored in low-moisture biscuit manufacturing because it decomposes completely into gases without leaving a solid residue?
(A) Sodium bicarbonate alone
(B) Monocalcium phosphate
(C) Ammonium bicarbonate
(D) Potassium acid tartrate

109. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Chlorinated flour is traditionally used in the production of high-ratio cakes (cakes with higher sugar than flour).
Reason (R): Chlorination lowers the gelatinization temperature of the starch and increases water-holding capacity, preventing the cake structure from collapsing under the weight of high sugar and liquid.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

110. Which of the following statements correctly describes aeration in puff pastry production?
(A) Biological aeration achieved by yeast fermentation during a twenty-four hour rest.
(B) Chemical aeration driven by high doses of sodium baking powder folded into dough.
(C) Lamination; during baking, water vaporizes and expands between dough-fat layers.
(D) Mechanical aeration from whipping the flour and water into a stable foam matrix.

111. Match the common cake defect in List I with its primary cause in List II:
List I: (Cake Defect)
P. Cake sinks in the middle
Q. Cake has a tough, rubbery texture
R. Cake is too pale
S. Cake has a peaked, cracked center
List II: (Primary Cause)
I. Oven temperature too high
II. Too much sugar or under-baking
III. Oven temperature too low
IV. Over-mixing the batter (excessive gluten development)
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-IV, R-III, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-IV, Q-II, R-I, S-III

112. Which of the following statements about cookie (biscuit) manufacturing is incorrect?
(A) The "spread" of a cookie during baking is heavily influenced by the coarseness of the sugar used.`
(B) Soft wheat flours with low protein content (7-9%) are generally preferred for cookie manufacturing.`
(C) Rotary molding is a common forming method for dry, crumbly doughs with high fat content.`
(D) Lowering the pH of the cookie dough typically increases browning during baking.`

113. A critical step for puff pastry requires the dough to be rested under refrigeration between folding (turns). What is the primary functional reason for this resting period?
(A) To relax gluten and keep the laminating fat solid, preventing melting.
(B) To allow yeast to ferment and release maximum carbon dioxide gases.
(C) To initiate the non-enzymatic Maillard browning reaction early.
(D) To allow chemical leavening agents to dissolve in cold formula water.

Downloaded from www.pdf.tube

to improve gas retention

131. Which of the following ingredients is NOT functionally used as a dough relaxer (reducing agent) in bread making?
(A) Ascorbic acid
(B) L-Cysteine
(C) Sodium metabisulfite
(D) Inactivated yeast (glutathione)

132. Read the following statements and choose the correct option:
Statement I: "Rope" disease in bread is characterized by a sticky, stringy crumb and an odor resembling overripe melons.
Statement II: Rope disease is caused by heat-resistant spores of Bacillus subtilis that survive the baking process.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

133. A food technologist is formulating a low-fat cake and a high-volume crusty bread. Applying concepts of emulsifier functionality, which emulsifiers should be selected for each respectively?
(A) SSL for cake softness, and lecithin for general bread crumb aeration.
(B) Mono-diglycerides for cake aeration, and DATEM for bread strength.
(C) DATEM for cake structure, and mono-diglycerides for general bread.
(D) Propionate for cake mold protection, and ascorbic acid for bread.

134. A commercial bakery receives complaints that their sliced sandwich bread is developing green mold within 2 days of purchase. The formulation includes standard levels of calcium propionate. What is the most likely operational failure leading to this defect?
(A) Slicing the bread after baking at a extremely high oven temperature.
(B) Over-mixing the bread dough during the initial development stage.
(C) Slicing and packaging the bread while warm, creating condensation.
(D) Using bread flour that possessed an extremely low protein content.

NODIA

135. What is the cause-and-effect relationship of overdosing a bread dough with a strong oxidizing agent like ascorbic acid?
(A) Excessive oxidation → complete breakdown of gluten → flat, liquid dough.
(B) Excessive oxidation → destruction of yeast → zero gas production.
(C) Excessive oxidation → highly extensible dough → high loaf volume.
(D) Excessive oxidation → over-strengthened tight gluten → low volume.

136. In the production of beer, what does the term "Mashing" specifically define?
(A) Enzymatic conversion of starch in malted barley to sugars in warm water.
(B) Physical crushing of harvested wine grapes to extract raw liquid juice.
(C) Thermal boiling of extracted liquid wort together with flavoring hops.
(D) Distillation of fermented grain mash to increase the alcohol content.

137. Consider the following statements regarding the production of wine:
1. Crushing breaks the grape skins to release the juice (must) for fermentation.
2. Red wine is fermented with the grape skins and seeds present to extract anthocyanins and tannins.
3. Racking is the process of siphoning the clear wine off the settled lees (dead yeast and debris).
4. Malolactic fermentation is exclusively used in all white wines to increase sharp acidity.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 2, and 3
(C) 2, 3, and 4
(D) 1, 3, and 4

138. The fundamental principle behind the distillation of spirits (e.g., whiskey, vodka) is based on the fact that:
(A) Alcohol has a higher boiling point than water, so water evaporates first.
(B) Ethanol has a lower boiling point than water, allowing selective vaporization.
(C) Alcohol freezes at a higher temperature than water, enabling cryo-concentration.
(D) Alcohol chemically reacts with copper metal stills to yield a purer end product.

90. What is the primary cause-and-effect relationship that leads to "Fat Bloom" in chocolate?
(A) High humidity storage → surface moisture dissolves sugar → recrystallization.
(B) Improper tempering → fat transition to stable polymorphs → surface migration.
(C) Excessive conching time → extreme volatilization of lipids → dry appearance.
(D) Lack of emulsifiers → milk protein precipitation → white surface spotting.

91. What accurately defines "Gluten" in the context of bread making?
(A) A visco-elastic protein network formed from hydrated gliadin and glutenin.
(B) A naturally occurring simple sugar in wheat flour that feeds the yeast.
(C) A functional enzyme that breaks starch down into fermentable maltose.
(D) The starchy endosperm portion of wheat that forms the crumb structure.

92. Consider the following statements about the function of ingredients in bread making:
1. Yeast (Saccharomyces cerevisiae) ferments sugars to produce carbon dioxide and ethanol.
2. Salt (Sodium chloride) strengthens the gluten network and regulates yeast activity.
3. Sugar is added solely for sweetening and plays no role in crust color development.
4. Fat (shortening) tenderizes the crumb and improves the shelf-life of the bread.

Which of the statements given above are correct?
(A) 1, 3, and 4
(B) 2, 3, and 4
(C) 1, 2, and 4
(D) 1, 2, and 3

93. Which specific microorganism is the primary biological leavening agent used in commercial bread making?
(A) Lactobacillus bulgaricus
(B) Aspergillus oryzae
(C) Leuconostoc mesenteroides
(D) Saccharomyces cerevisiae

94. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): The omission of salt in a bread dough formulation will result in a dough that is sticky, difficult to handle, and ferments too rapidly.
Reason (R): Salt exerts an osmotic pressure that retards yeast activity and also interacts with gluten proteins to tighten and strengthen the dough network.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

95. Which of the following statements about the baking process of bread is correct?
(A) Starch gelatinization in bread dough only starts at temperatures well above 95°C.
(B) Oven spring refers to rapid initial dough expansion in the oven due to gas expansion.
(C) The crust color is formed entirely through enzymatic browning from polyphenol oxidase.
(D) Yeast cells remain active throughout the baking period until the loaf is harvested.

96. Match the bread fault in List I with its most likely cause in List II:
List I: (Bread Fault)
P. Dense crumb, poor volume
Q. Very dark crust color
R. Large, irregular holes in crumb
S. Blisters on the crust
List II: (Primary Cause)
I. Excessive sugar in the formulation
II. Over-proofing the dough
III. Yeast failure or dead yeast
IV. Excessive moisture or condensation during baking
(A) P-I, Q-II, R-III, S-IV
(B) P-III, Q-IV, R-I, S-II
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-I, R-II, S-IV

97. Which of the following statements about the role of water in bread dough is incorrect?
(A) Hard water minerals weaken the gluten network and cause dough collapse.
(B) Water is required for the hydration of wheat gliadin and glutenin.
(C) Water acts as a primary solvent for added sugar, salt, and yeast.
(D) Water temperature directly controls the overall rate of fermentation.

Click Here to Buy book on Amazon

skins.
(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

148. Applying chemical preservation principles in enology, why is sulfur dioxide (SO_2) routinely added to wine must and finished wine?
(A) It functions exclusively as a highly effective red color stabilizing agent.
(B) It catalyzes the natural enzymatic conversion of malic acid into lactic acid.
(C) It raises total alcohol yield by accelerating active yeast fermentation.
(D) It acts as both an antioxidant and an antimicrobial agent in the wine.

NODIA

149. A food inspector inspects a batch of commercial beer and notices it turns severely cloudy only when refrigerated, but becomes clear again at room temperature. What is this defect, and what causes it?
(A) Biological haze caused by the uncontrolled growth of wild brewing yeasts during storage.
(B) Chill haze caused by the cross-linking of proteins and polyphenols at low temperatures.
(C) Starch haze resulting from incomplete enzymatic breakdown of starches during mashing.
(D) Oxidation haze formed because of poor physical bottle sealing and air ingress.

150. What is the consequence of adulterating pure roasted coffee powder with undeclared roasted chicory root?
(A) It dramatically and dangerously increases the overall caffeine content of the blend.
(B) It imparts a lighter color and significantly reduces the viscosity of the final brew.
(C) It alters flavor and creates a thicker, darker brew due to soluble extractives.
(D) It completely prevents any Maillard browning reactions from occurring during roasting.

occurs between reducing sugars and amino acids at high temperatures, producing thousands of volatile flavor compounds and dark melanoidin pigments that define the characteristic sensory profile of brewed coffee.

19. (A) Both A and R are true and R is the correct explanation of A.
Arabica coffee grown at high altitudes possesses high natural acidity due to slow bean maturation. Processing these cherries using the wet method preserves this desirable trait. By quickly removing the outer pulp and fermenting the mucilage, wet processing prevents heavy, fruity fermentation flavors from masking the clean, bright, and tangy phosphoric and malic acid notes of the beans.

20. (D) A burr grinder produces a more uniform particle size distribution compared to a blade grinder.
Grinding is critical for optimizing soluble solids extraction from roasted coffee. A burr grinder utilizes two revolving abrasive surfaces to crush beans into highly uniform particles, ensuring even water flow and balanced extraction. Conversely, blade grinders chop beans randomly, producing an inconsistent mix of coarse chunks and fine dust, which leads to uneven extraction and bitter cup profiles.

21. (B) P-III, Q-II, R-IV, S-I
Physical and chemical coffee defects arise from specific agricultural or processing errors. Black beans stem from dead or diseased fruit before harvest. Sour beans occur when over-fermentation generates sour aliphatic acids. Stinker beans are caused by prolonged contact with foul water during pulping, while quaker beans remain pale because unripe cherries lack the sugars needed for roasting.

22. (C) Robusta beans are primarily valued for their complex acidity and delicate floral aromas.
Robusta coffee beans are characterized by high caffeine content, low acidity, and a heavy body, often yielding earthy, woody, or bitter flavors. They are not valued for complex acidity or delicate floral aromas, which are defining sensory characteristics of premium Arabica beans. Improper drying and storage of either species can introduce undesirable moldy or earthy defects.

23. (D) 2-1-3-4
The wet preparation of coffee follows a highly standardized processing sequence. Harvested cherries are first passed through mechanical pulpers to strip away the outer skin. The pulped beans then undergo controlled fermentation to break down the sticky mucilage layer. After fermentation, the beans are washed to remove residual debris and finally dried to stable moisture levels.

24. (A) Body - Mouthfeel and heaviness of the brew
In coffee sensory analysis, specific terms describe distinct physical and chemical attributes. Body refers to the tactile sensation of weight, viscosity, and thickness of the liquid on the tongue. In contrast, acidity represents a bright, tangy flavor sensation, aroma encompasses volatile scent compounds perceived by the nose, and bitterness is a complex taste derived primarily from roasting reactions.

25. (B) Dark Roast - Dominant roast notes with higher caffeine content
Coffee roasting thermally degrades chemical compounds inside the bean. While light roasts preserve high acidity and origin-specific flavors, dark roasts feature dominant smoky, bitter notes because of extensive pyrolysis. Importantly, the intense heat of dark roasting slightly reduces the overall caffeine content through sublimation, meaning dark roasts do not possess higher caffeine levels than lighter roasts.

26. (B) Peaberry
Green coffee defects include physical abnormalities that negatively affect cup quality, such as insect-damaged, broken, or black beans. A peaberry, however, is not a defect but a natural mutation where only one rounded bean develops inside the cherry instead of two flat ones. Peaberries are highly prized for their uniform roasting characteristics and concentrated flavor profiles.

27. (A) Both Statement I and Statement II are true
The dry processing method involves drying the whole, intact coffee cherry under the sun. This prolonged contact between the bean and the sweet fruit pulp allows soluble sugars to migrate inward, imparting a heavy body and fruity notes. Because the fruit is dried whole, mechanical pulpers are completely omitted from this specific processing line prior to drying.

Downloaded from www.pdf.tube

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

Theaflavins are orange-red pigments that impart bright golden colors and vital briskness to black tea liquors. In contrast, unoxidized catechins produce green tea bitterness, thearubigins provide deep red colors and body, caffeine yields bitterness and stimulating properties, and volatile compounds contribute complex floral aromas.

10. (B) Fermentation - Anaerobic microbial degradation of leaf sugars
In tea processing, the term fermentation is actually a misnomer because it does not involve anaerobic microbial action on sugars. Instead, this crucial step is a purely aerobic, enzymatic oxidation process. During this stage, endogenous polyphenol oxidase enzymes react with atmospheric oxygen to convert monomeric tea catechins into complex dimeric and polymeric polyphenols, which define black tea characteristics.

11. (A) Anthocyanins
Black tea quality evaluation focuses on compounds directly generated or modified during processing. Theaflavins and thearubigins, produced via enzymatic oxidation of monomeric catechins, are primary markers for liquor brightness, body, and color. While unoxidized catechins indicate the level of fermentation completed, anthocyanins are minor pigments that do not serve as primary parameters for evaluating black tea liquor.

12. (A) Both Statement I and Statement II are true
Green tea retains high concentrations of monomeric catechins, particularly epigallocatechin gallate, because immediate enzyme inactivation prevents oxidation. In contrast, black tea processing includes a fermentation step where these monomeric catechins undergo significant enzyme-catalyzed oxidation. This biochemical pathway converts the simple catechins into complex, oxidized polyphenolic compounds, specifically dimeric theaflavins and high-molecular-weight, dark-colored thearubigins.

13. (D) Rapid steaming or pan-firing of the fresh leaves
To prevent enzymatic browning and preserve high levels of natural antioxidant catechins, fresh tea leaves must undergo immediate thermal treatment. Applying rapid steaming or pan-firing directly after harvest denatures endogenous polyphenol oxidase enzymes. This thermal denaturation halts the oxidation pathway completely, preserving the natural green color, fresh flavor, and rich monomeric catechin profile of the leaves.

14. (C) Over-fermentation converted most of the bright theaflavins into duller thearubigins.
During the fermentation phase of black tea processing, timing is highly critical. Normal oxidation yields an optimal balance of bright, brisk theaflavins and deep, rich thearubigins. If fermentation is allowed to proceed too long, the bright theaflavins are progressively oxidized into duller, high-molecular-weight thearubigins, resulting in a flat, dark liquor that lacks necessary briskness and vibrancy.

15. (B) It leads to case-hardening and a burnt or smoky off-flavor.
Exposing tea leaves to excessively high temperatures during the drying phase causes rapid surface moisture loss. This physical phenomenon, known as case-hardening, traps residual moisture inside the leaves while creating a hard outer shell. Additionally, these extreme thermal conditions trigger pyrolysis of chemical constituents, leading to undesirable burnt, smoky off-flavors and a significant loss of delicate volatile compounds.

16. (D) Pulping the cherry and fermenting the sticky mucilage layer before drying the parchment beans.
Wet processing of coffee requires several precise mechanical and biochemical steps. First, fresh cherries are depulped to remove the outer skin. The remaining parchment beans, covered in a sticky, pectin-rich mucilage layer, are fermented in water tanks to break down this mucilage. Once the mucilage is solubilized, the clean parchment beans are thoroughly washed and dried.

NODIA

17. (A) 1, 2, and 4
Dry coffee processing leaves the fruit intact, yielding sweet, full-bodied brews with low acidity. During wet processing, over-fermentation allows wild microorganisms to produce volatile organic acids, causing the highly offensive stinker bean defect. Furthermore, the first crack in roasting marks a physical transition where moisture turns to steam, causing beans to expand and audibly rupture.

18. (C) Maillard reaction
The roasting of green coffee beans is dominated by complex thermal reactions. The Maillard reaction is the primary pathway responsible for flavor, color, and aroma development. This reaction

77. (D) 1, 3, and 4
Chocolate tempering is a controlled thermal process designed to precrystallize cocoa butter. The primary goal is to promote the formation of stable Form V polymorph crystals while avoiding unstable Form I through IV polymorphs. Proper tempering ensures a glossy finish, clean snap, and resistance to fat bloom, which occurs when unstable crystals transition over time.

78. (C) To knead and aerate the mass to reduce moisture, acidity, and particle size.
Conching is a critical, long-duration kneading and aerating process in chocolate manufacturing. Operating at elevated temperatures, conching drives off moisture and undesirable volatile organic acids, such as acetic acid. It also coats solid sugar and cocoa particles with liquefied cocoa butter, eliminating grittiness and developing the characteristically smooth texture and rich aroma of chocolate.

79. (C) A is true but R is false.
In sugar confectionery, doctoring agents like invert sugar or glucose syrup are added to hard-boiled candy formulations. These agents act as crystallization inhibitors. Because they increase the solubility of sucrose and physically interfere with sucrose molecular alignment, they prevent unwanted crystallization, helping to maintain the desired clear, amorphous glass structure of the candy.

80. (D) Gelatin or pectin are added to establish the characteristic chewy gel network.
Gummy confections are gel-based sweets with a moderately high moisture content of around fifteen percent. Their characteristic chewy, elastic, or gummy texture is achieved by incorporating gelling hydrocolloids, such as gelatin, pectin, or starch. Sucrose crystallization is intentionally prevented in these formulations to ensure the product remains clear, smooth, and chewy.

81. (A) P-II, Q-I, R-IV, S-III
Confectionery products are distinguished by their physical structures. Hard-boiled candies are amorphous glasses with very low moisture. Toffee is a cooked emulsion of sugar syrup, fat, and milk solids. Gummy candies rely on hydrocolloids like gelatin for their chewy texture, and fondant is a microcrystalline mass of sugar suspended in saturated syrup.

82. (C) Toffee requires complete sugar inversion to form a hard, non-chewy brittle glass.
Toffee is a complex emulsion containing sugar syrup, fat, and milk solids. Milk proteins are essential for flavor development through Maillard browning during cooking, and emulsifiers like lecithin stabilize the fat dispersion. Toffee does not require complete sugar inversion; instead, uncontrolled inversion would make the product sticky and soft rather than cohesive and chewy.

83. (A) Fat bloom melts upon gentle rubbing, while sugar bloom dissolves in water.
White surface discoloration on chocolate can be fat bloom or sugar bloom. Fat bloom consists of recrystallized cocoa butter, which melts when gently rubbed due to body heat. Sugar bloom, on the other hand, consists of recrystallized sugar caused by moisture exposure; these crystals do not melt with gentle rubbing but dissolve when a drop of water is applied.

84. (D) Winnowing - Removing the shell from the roasted cocoa nibs
Winnowing is a mechanical step in chocolate processing where roasted cocoa beans are cracked, and air currents separate the light outer husks from the heavy, oil-rich inner nibs. In contrast, enrobing is coating a pre-formed center with chocolate, tempering is controlling lipid crystallization, and fermentation is an agricultural step that develops flavor precursors in raw beans.

85. (B) Invertase - Hardens the center of liquid-filled chocolates
Invertase is an enzyme used in confectionery to soften, not harden, fondant centers. When added to a solid fondant center before enrobing, the enzyme slowly hydrolyzes sucrose into highly soluble glucose and fructose over time. This reaction liquefies the center inside the chocolate shell, creating a liquid-filled confection without leaking during production.

86. (C) Liquid soybean oil
Cocoa butter equivalents must possess physical and chemical properties highly similar to cocoa butter, specifically high concentrations of symmetrical monounsaturated triacylglycerols. Fats like sal, illipe, and kokum gurgi are highly suitable after processing. Liquid soybean oil, which is rich in polyunsaturated liquid fatty acids, cannot form the hard crystal structure required for chocolate.

Click Here to Buy book on Amazon

28. (C) Fine the grind size to lengthen the extraction time.
An espresso shot that extracts too quickly and tastes thin and sour is under-extracted. Adjusting the grinder to a finer setting decreases the gaps between coffee particles, creating greater resistance to the pressurized water. This adjustment increases the contact time, allowing water to extract the balanced sweet and bitter compounds necessary to correct the sour flavor profile.

29. (D) Fungal contamination of the coffee cherries during drying on the ground.
The highly undesirable medicinal, phenolic, or iodine-like off-flavor known as the Rioy defect is a major sensory flaw in coffee. This defect is primarily caused by fungal and microbial contamination, particularly by species like Aspergillus, which proliferate when harvested coffee cherries are allowed to dry slowly in direct, prolonged contact with damp ground or soil.

30. (C) Excessive pyrolysis and loss of unique origin flavors.
Roasting coffee beans significantly past the second crack subjects the cellular structure to extreme thermal stress. This intense heat causes severe pyrolysis, destroying chlorogenic acids, delicate floral esters, and sweet carbohydrates. Consequently, the unique origin-specific flavor characteristics of the bean are completely lost, replaced by dominant, generic notes of bitter carbon, ash, and heavy smoke.

31. (B) The process of dissolving carbon dioxide gas in a liquid under pressure.
Carbonation is a fundamental unit operation in beverage manufacturing, defined as dissolving carbon dioxide gas into water or liquid mixtures under controlled pressure. This process relies on gas solubility principles to create carbonic acid, which imparts the characteristic effervescent sparkle, provides a unique tingling mouthfeel, and lowers beverage pH, helping to enhance overall preservation.

32. (D) 1, 2, and 4
Achieving optical clarity in fruit juices requires targeted physical and chemical treatments. Pectinase enzymes break down structural pectins to reduce viscosity and prevent persistent cloudiness. Bentonite clay and gelatin act as effective fining agents by binding with proteins and suspended polyphenols to form heavy precipitates. Centrifugation alone cannot remove sub-micron colloidal particles without these enzymatic and fining pretreatments.

33. (A) 85-95°C for 15-30 seconds
High-Temperature Short-Time pasteurization of acidic fruit juices is designed to ensure microbial safety while preserving sensory quality. Heating the juice to temperatures between eighty-five and ninety-five degrees Celsius for fifteen to thirty seconds effectively destroys vegetative spoilage microorganisms and inactivates pectinesterase enzymes, without causing the severe thermal damage associated with longer cooking processes.

34. (A) Both A and R are true and R is the correct explanation of A.
Carbonation efficiency is highly dependent on liquid temperature. According to Henry's Law, the solubility of a gas in a liquid is inversely proportional to temperature. Chilling the beverage water to temperatures between zero and four degrees Celsius maximizes the absorption of carbon dioxide, reducing gas loss during bottling and ensuring a stable, highly effervescent carbonated soft drink.

35. (A) Carbonated water and concentrated flavored syrup are blended at the point of dispensing.
Dispensing carbonated beverages utilizes two primary systems. The post-mix method is widely used in soda fountains, where purified, carbonated water and concentrated flavored syrup are stored separately and blended in a precise ratio only at the actual moment of dispensing. This system significantly reduces shipping costs and storage space compared to pre-mixed, bottled beverages.

36. (D) P-IV, Q-III, R-II, S-I
Fruit juice extraction equipment is engineered for specific structural food properties. Citrus reamers extract juice from halved fruits while avoiding bitter peel oils. Hydraulic presses are ideal for batch-pressing whole apples. Decanter centrifuges continuously separate liquid from highly fibrous purees like mango, and screw presses excel at the continuous extraction of grape or apple pulp.

37. (B) Aseptic packaging requires the juice to be filled into unsterilized cartons and then heated.
Aseptic packaging requires filling a pre-sterilized, cooled beverage into a sterile packaging material under a highly controlled, sterile environment. This

Downloaded from www.pdf.tube

technique completely avoids heating the product inside the final container. Deaeration is routinely performed beforehand to protect oxygen-sensitive ascorbic acid, and homogenization prevents pulp separation in cloudy juices to maintain product stability.

38. (C) 2-4-1-3
Soft drink manufacturing requires a precise assembly line. Purified water is first treated to eliminate minerals and organic matter. This treated water is then blended with prepared flavor syrups in exact ratios using a proportioner. The blended mixture is carbonated by dissolving carbon dioxide under high pressure, and the finished beverage is immediately filled and capped.

39. (D) Proportioner - Mixes water and syrup in exact ratios
Accurate ingredient blending is essential in soft drink manufacturing. The proportioner is a highly specialized metering system designed to continuously blend purified water and concentrated syrup in exact, pre-determined ratios. Conversely, a deaerator removes dissolved oxygen, a carbonator dissolves carbon dioxide gas into the liquid, and a pasteurizer uses heat to eliminate vegetative microorganisms.

40. (A) Saponin - Emulsifier used to prevent flavor ring formation
Soft drink ingredients must serve specific technical functions. Phosphoric acid provides a sharp, tangy taste in colas, sodium benzoate prevents microbial growth, and aspartame acts as a low-calorie sweetener. Saponin is not used to prevent flavor rings; instead, weighting agents like ester gum or sucrose acetate isobutyrate are employed to stabilize flavoring oil emulsions.

41. (B) Boiling the beverage to release endogenous CO_2
Carbonation relies on introducing carbon dioxide gas into a liquid, which can be accomplished via pressurized tank sparging, in-line venturi injection, or in-bottle biological fermentation. In contrast, heating or boiling a liquid decreases gas solubility and drives off dissolved gases, making boiling completely useless as a method for carbonating or preserving effervescent beverages.

42. (C) Statement I is true but Statement II is false
The Brix-to-acid ratio is a highly reliable quality index for determining the maturity and palatability of citrus fruit. A higher ratio indicates that the fruit has accumulated more sugars relative to organic acids, representing a sweet, mature, and desirable flavor profile. Conversely, a lower ratio indicates an immature, sour fruit with high acid concentrations.

43. (A) Adding ascorbic acid to the apple mash during crushing.
Enzymatic browning during apple crushing is caused by polyphenol oxidase, which oxidizes polyphenols in the presence of oxygen. Adding ascorbic acid is an effective intervention because it acts as a powerful reducing agent. It chemically reduces intermediate quinones back into colorless phenols, effectively preventing browning before the juice can be pressed and pasteurized.

44. (C) The temperature of the carbonated beverage during filling is too high.
Excessive foaming or fobbing during the bottling of carbonated beverages indicates that dissolved carbon dioxide is rapidly escaping from solution. Because gas solubility is inversely proportional to temperature, warming of the liquid prior to filling significantly reduces CO_2 solubility. This physical change causes the gas to flash out of solution, leading to foaming and underfills.

45. (D) Rapid loss of ascorbic acid and creation of oxidized off-flavors.
Failing to remove dissolved oxygen from fruit juice before heating leads to severe chemical degradation. During thermal pasteurization, residual oxygen reacts rapidly with ascorbic acid, causing its destruction and reducing the nutritional value of the juice. Furthermore, this oxidation process triggers the formation of undesirable volatile compounds, resulting in stale, oxidized off-flavors and discoloration.

46. (C) A dense mixture of sugar crystals and suspended mother liquor.
In sugarcane processing, massecuite is the technical term for the highly viscous, dense slurry obtained from the vacuum pans. It consists of newly crystallized sucrose suspended within a concentrated mother liquor, or syrup. This thick mixture is subsequently transferred to industrial centrifuges, where the solid sugar crystals are separated from the remaining liquid molasses.

NODIA

47. (B) 1, 2, and 3
Sugarcane clarification utilizes several chemical pathways to precipitate impurities. Defecation neutralizes organic acids using heat and milk of lime. Sulfitation introduces sulfur dioxide to bleach pigments and control color. Carbonatation utilizes lime and carbon dioxide to form calcium carbonate, which traps suspended matter. Clarification aims to remove non-sugar solids, not to increase moisture before crystallization.

48. (D) Multiple-effect vacuum evaporator system
Concentrating clarified sugarcane juice containing approximately fifteen percent solids into a thick syrup with seventy percent solids requires efficient water removal. A multiple-effect vacuum evaporator system is the industrial standard. Operating under progressive vacuum lowers the boiling point of the juice in successive stages, maximizing energy efficiency by reusing steam and protecting sucrose from thermal degradation.

49. (A) Both A and R are true and R is the correct explanation of A.
Sugar crystallization is carried out in specialized vacuum pans to protect sucrose from heat damage. Because high temperatures cause rapid sucrose inversion and caramelization, boiling the thick syrup under a partial vacuum significantly lowers its boiling point. This operational technique allows crystallization to proceed efficiently at lower temperatures, preserving sugar yield and color quality.

50. (C) Adding fine sugar dust to initiate crystal growth in a supersaturated syrup.
Commercial sugar crystallization requires careful control of supersaturation. Spontaneous nucleation often produces irregular, low-quality crystals. To achieve a uniform crystal size, the thick syrup is brought to a specific level of supersaturation, and fine sugar dust, or slurry, is introduced as seeds. These seeds provide nucleation sites, promoting even, controlled crystal growth.

51. (A) P-III, Q-I, R-IV, S-II
Sugar refining involves highly specialized chemical and physical purification steps. Affination washes raw sugar crystals with heavy syrup to remove the surface molasses layer. Decolorization uses carbon or bone char to remove pigments. Centrifugation mechanically separates raw sugar crystals from the massecuite slurry, leaving behind molasses, which is the final viscous by-product.

52. (D) Bone char is strictly plant-based and is the only legal decolorant for refined sugar globally.
Bone char is an animal-derived material made from carbonized cattle bones, making the assertion that it is plant-based completely incorrect. In modern global sugar refining, several other highly effective, kosher, and halal-friendly alternative decolorizing technologies are legally permitted and widely used, including granular activated carbon, synthetic ion-exchange resins, and advanced polymeric adsorbents.

53. (B) 2-1-4-3
Sugarcane processing follows a rigorous, logical flow to maximize sugar recovery. Harvested stalks are first milled to extract raw juice. This juice is clarified using lime and heat to precipitate impurities. The clear juice is concentrated into syrup within multiple-effect evaporators, and the syrup is finally boiled in vacuum pans to initiate crystallization.

54. (C) Bagasse - Fuel for electricity and steam cogeneration in processing
Sugarcane processing yields valuable industrial by-products. Bagasse, the fibrous residue remaining after juice extraction, is primary used as a biomass fuel in factory boilers to generate steam and electricity, making mills self-sufficient. Conversely, molasses is fermented into ethanol or rum, and filter mud is applied to agricultural fields as a nutrient-rich fertilizer.

55. (D) Clarifier - Centrifugal separation of final sugar crystals
Sugar factory equipment is engineered for specific separation and processing tasks. Shredder knives prepare cane, roller mills extract juice, and evaporators concentrate it. A clarifier is a settling tank that uses gravity to separate precipitated impurities from clear juice. It is not used for crystal separation; instead, high-speed centrifuges are employed for that purpose.

56. (A) Malting
Sugar refining focuses on purifying raw sucrose through physical and chemical steps, including affination to remove surface molasses, decolorization to eliminate pigments, and recrystallization to produce white sugar. Malting is a biochemical process used in brewing to germinate barley and develop amylase enzymes; it has no application in cane sugar refining.

Click Here to Buy book on Amazon

ANSWERS

1. (A) Tea leaves that undergo full enzymatic oxidation of catechins before drying.
Black tea manufacturing requires complete enzymatic oxidation, commonly called fermentation. During this critical stage, naturally occurring polyphenol oxidase enzymes catalyze the oxidation of colorless monomeric catechins into complex, colored compounds like theaflavins and thearubigins. This chemical transformation is halted by drying, which inactivates the enzymes and establishes the dark color and characteristic flavor.

2. (C) 1, 2, and 4
Withering physically prepares tea leaves by reducing moisture to make them pliable. Rolling physically disrupts cell structures, releasing chemical compounds and initiating enzymatic oxidation. Fermentation must occur at controlled, moderate temperatures, typically between twenty and thirty degrees Celsius, to prevent enzyme denaturation. Firing finally stops all enzymatic activity and lowers leaf moisture to ensure stability.

3. (A) Polyphenol oxidase
During the processing of black tea, polyphenol oxidase is the primary enzyme driving the oxidation of catechins. This copper-containing enzyme catalyzes the conversion of simple monomeric flavan-3-ols into dimeric theaflavins and polymeric thearubigins. This biochemical pathway directly establishes the unique color, body, astringency, and overall aroma profile characteristic of fully oxidized black tea brews.

4. (A) Both A and R are true and R is the correct explanation of A.
Oolong tea is classified as a semi-oxidized tea, placing its sensory profile directly between unoxidized green tea and fully oxidized black tea. This intermediate character is achieved by allowing enzymatic oxidation to proceed only partially before applying heat. The thermal treatment deactivates polyphenol oxidase enzymes, successfully halting chemical conversion and preserving the unique, balanced flavor attributes.

5. (B) Theaflavins contribute primarily to the bright golden color and brisk taste of the tea liquor.
Theaflavins are biologically active dimeric polyphenols formed during the enzymatic oxidation of tea catechins. These compounds are highly critical to black tea quality because they directly contribute to the bright, golden-yellow color of the liquor and provide the essential sensory characteristics of briskness and freshness, which are highly prized by tea tasters worldwide.

6. (C) P-IV, Q-III, R-I, S-II
Distinct tea types are defined by their unique processing methods. Green tea undergoes rapid steaming or pan-firing to inactivate enzymes. Black tea is fully oxidized to convert catechins into complex pigments. Oolong tea undergoes partial oxidation to balance flavor characteristics. White tea is subjected to minimal processing, consisting primarily of careful withering followed by direct air-drying.

NODIA

(D) White tea undergoes the most rigorous rolling and cutting processes among all tea types.
White tea is distinguished by its minimal processing, which completely avoids heavy rolling, tearing, or shape manipulation to preserve the natural state of delicate young buds and leaves. Conversely, black tea processing involves intense physical rolling or high-shear cutting, particularly in the crush-tear-curl method, which fully disrupts cell structures to maximize chemical oxidation and liquor strength.

8. (A) 3-1-4-2
The standard manufacture of orthodox black tea follows a precise, logical sequence. Freshly plucked leaves first undergo withering to reduce moisture and induce physical flaccidity. The withered leaves are then rolled to disrupt cellular structures and release juice. This physical damage initiates enzymatic oxidation during fermentation, which is finally halted by thermal drying to stabilize the tea.

9. (B) Theaflavins - Liquid briskness and golden color
Tea quality is closely linked to specific chemical compounds developed during processing.

67. (A) Vacuum pans and multiple-effect evaporators are the standard equipment used for rural jaggery production.
Rural jaggery production is a traditional cottage industry that relies on simple, open-pan evaporators heated by direct wood or bagasse fires. It does not use expensive, industrial multiple-effect vacuum evaporators. The juice is boiled at atmospheric pressure until it reaches a striking temperature of around one hundred fifteen to one hundred twenty degrees Celsius.

68. (D) 1-2-3-4
Commercial honey processing follows a careful sequence to preserve sensory and nutritional quality. Honey is first extracted from uncapped combs using a centrifuge. The raw honey is gently warmed to reduce its viscosity and dissolve minor crystals. It is then filtered to remove wax, pollen clusters, and debris, and finally filled into sterile bottles.

69. (B) Most abundant sugar - Natural fructose
Honey is a natural supersaturated sugar solution produced by honeybees. Its chemical composition is dominated by simple monosaccharides rather than complex disaccharides. Fructose is the most abundant sugar present, followed closely by glucose. This high fructose concentration gives honey its high relative sweetness, high hygroscopicity, and unique physical properties, including its tendency to resist rapid crystallization.

70. (C) Khandsari - Pure refined white sugar
Traditional Indian sweeteners are classified by their processing methods. Gur represents fully solidified jaggery blocks, kakvi is a viscous liquid jaggery syrup, and shakkar is a granular jaggery powder. Khandsari is not a pure refined white sugar; instead, it is a semi-refined, yellowish crystalline sugar produced through open-pan concentration and basic centrifugal separation.

71. (D) High Fructose Corn Syrup (HFCS))
Pure commercial honey is legally defined as a natural food product with no added ingredients. While natural pollen, enzymes like diastase, and trace wax fragments are normal components, adding high fructose corn syrup is strictly prohibited. Doing so constitutes illegal food adulteration, which is routinely detected using isotope ratio mass spectrometry or high-performance liquid chromatography.

72. (A) Both Statement I and Statement II are true
Honey crystallization is a natural physical process that occurs when glucose, which is less soluble than fructose, precipitates out of the supersaturated solution. This change does not indicate spoilage or adulteration. Gently heating the crystallized honey in a warm water bath easily dissolves the glucose crystals, restoring the honey to a smooth, liquid state.

73. (B) Briefly pasteurizing at 70°C to destroy active osmophilic yeasts.
Honey with a moisture content near twenty percent is highly susceptible to fermentation by wild, osmophilic yeasts. To prevent this spoilage without using artificial chemical additives, processors subject the honey to brief thermal pasteurization at seventy degrees Celsius. This heat treatment destroys yeast cells and dissolves micro-crystals, ensuring long-term microbial and physical stability.

74. (B) The honey is adulterated with cane sugar or corn syrup.
Standard honey contains very low amounts of sucrose, and a level of fifteen percent is a clear indicator of adulteration. Furthermore, a positive C4 sugar isotope test proves the introduction of sugars derived from C4 photosynthetic plants, such as sugarcane or corn, confirming that the product has been diluted with cheap syrups.

75. (A) It suffers from rapid mold growth and spoilage.
Packaging jaggery with an excessively high moisture content poses a severe shelf-life risk. Water activity in wet jaggery is high enough to allow the growth of xerophilic molds and osmophilic yeasts. This microbial activity leads to rapid surface mold development, souring, liquefaction, and chemical degradation, rendering the product unmarketable and unsafe for consumption.

76. (C) An amorphous, non-crystalline glass state.
Hard-boiled candies are manufactured by boiling sugar and glucose syrups to very high temperatures, reducing moisture below two percent. When this concentrated mass is rapidly cooled, the sucrose molecules are prevented from organizing into a crystal lattice. This rapid cooling traps the mixture in a highly viscous, solid, amorphous glass state.

Downloaded from www.pdf.tube

57. (C) Statement I is true but Statement II is false
During sugarcane milling, water is sprayed onto the crushed cane bed before the final rollers. This process, called imbibition, dissolves and extracts residual sucrose trapped in the fibers. While this increases sucrose recovery, it also dilutes the juice, which actually increases the thermal load on the evaporators, requiring more energy to remove the added water.

58. (B) Adding a small amount of water to reduce the level of supersaturation.
False grain consists of tiny, unwanted crystals that form when syrup supersaturation rises too high into the labile zone. To dissolve these micro-crystals and restore controlled growth, the operator must slightly lower the supersaturation level. Adding a small, controlled amount of water or unsaturated juice safely dissolves the false grain without melting the larger, desired crystals.

59. (A) Poor exhaustion and crystal control in the boiling house.
Producing final molasses with high purity indicates that a significant amount of sucrose was not successfully crystallized. This processing failure stems from poor exhaustion of the mother liquor during the boiling stages, often caused by inadequate crystal seeding, incorrect vacuum pan control, or insufficient cooling crystallization, which prevents sucrose from depositing onto existing crystals.

60. (C) Acid-catalyzed inversion of sucrose occurs, reducing the final sugar yield.
Maintaining proper pH control is critical during sugarcane processing. If the juice pH is allowed to drop below five point five, the acidic conditions catalyze the chemical inversion of sucrose. This hydrolysis reaction breaks sucrose down into glucose and fructose, which cannot be crystallized, thereby significantly reducing the overall yield of white granulated sugar.

61. (D) Semi-refined sugar produced via open-pan evaporation and centrifugal separation.
Khandsari is a traditional, semi-refined yellow sugar produced in India. The process involves clarifying sugarcane juice with simple herbal or chemical clarifiers, concentrating it in open boiling pans, and allowing it to crystallize. The resulting massecuite is then spun in small-scale centrifuges to separate the sugar crystals from the molasses, yielding a non-refined sweetener.

62. (C) 1, 2, and 4
Honey quality is defined by strict chemical parameters. High-quality honey must have a moisture content below twenty percent to prevent fermentation, and a low hydroxymethylfurfural concentration, which indicates freshness. Fiehe's test is used to detect artificial invert sugar adulteration. Chemically, honey is primarily composed of monosaccharides, specifically fructose and glucose, with very little sucrose.

63. (B) Vegetative mucilage from plant roots
Traditional jaggery processing relies on natural clarifying agents to purify boiling sugarcane juice. Extract from the roots of plants like lady's finger or wild hibiscus is added to the boiling juice. This vegetative mucilage acts as a natural coagulant, binding with suspended solids, proteins, and colloidal impurities to form a thick scum that is easily skimmed off.

NODIA

64. (A) Both A and R are true and R is the correct explanation of A.
Hydroxymethylfurfural is an important indicator of honey quality and authenticity. This organic compound is produced by the acid-catalyzed dehydration of fructose, a reaction accelerated by heat. High concentrations of this compound show that the honey has been overheated during processing, stored under warm conditions for too long, or adulterated with cheap, heated invert sugar syrups.

65. (A) Gentle warming to 40-50°C to lower viscosity and aid filtration.
Honey processing requires gentle temperature control to preserve its delicate flavor and active enzymes. Warming honey to forty to fifty degrees Celsius lowers its viscosity, making it easy to filter out wax, bee parts, and debris. Boiling honey is avoided because extreme heat destroys natural enzymes, darkens the color, and generates high levels of hydroxymethylfurfural.

66. (C) P-IV, Q-II, R-III, S-I
Honey quality issues stem from specific chemical balances. Extracting unripened honey from unsealed combs results in high moisture content. High hydroxymethylfurfural levels indicate thermal damage or prolonged storage. Granulation occurs naturally when there is a high glucose-to-water ratio, and excess moisture allows osmophilic yeasts to multiply, causing fermentation and spoilage of the honey.

87. (A) Both Statement I and Statement II are true
Sugar inversion is the chemical or enzymatic hydrolysis of sucrose into its constituent monosaccharides, glucose and fructose. While minor inversion helps prevent sucrose crystallization in confectionery, excessive inversion is highly problematic. Fructose is extremely hygroscopic and absorbs moisture from the air, causing hard-boiled candies to become sticky, lose their glass state, and spoil.

88. (A) Water wets sugar crystals, causing them to clump and disrupt the continuous fat phase.
Melted chocolate is a suspension of solid sugar and cocoa particles in a continuous phase of liquid cocoa butter. Introducing even a tiny amount of water dissolves the surface of the sugar crystals, making them sticky. These sticky sugar particles clump together through cohesive forces, disrupting the continuous fat phase and causing the chocolate to seize into a thick, unworkable paste.

89. (B) Bean refining
A smooth, velvety mouthfeel in chocolate requires solid particles of sugar and cocoa to be reduced to a size below twenty microns, which is the sensory threshold for human tongue perception. If the refining step is inadequate, the solid particles remain too large, resulting in a gritty, sandy, and low-quality texture in the finished chocolate bar.

90. (B) Improper tempering → fat transition to stable polymorphs → surface migration.
Fat bloom on chocolate is caused by unstable cocoa butter crystals recrystallizing into more stable polymorphs over time. If chocolate is improperly tempered, unstable Form IV crystals dominate. These lipids eventually melt and recrystallize into the highly stable Form VI state. During this transition, they migrate to the surface and form a visible, white, crystalline film.

91. (A) A visco-elastic protein network formed from hydrated gliadin and glutenin.
Gluten is a complex, visco-elastic protein network that forms when wheat flour is hydrated and mixed. It is composed of two primary storage proteins: gliadin, which provides extensibility and dough flow properties, and glutenin, which imparts elasticity and resistance to extension. This network is essential for trapping carbon dioxide gas during fermentation and baking.

92. (C) 1, 2, and 4
Bread ingredients serve critical functional roles. Yeast ferments sugars to generate carbon dioxide and ethanol for leavening. Salt strengthens gluten and regulates yeast activity. Fat acts as a tenderizer by coating gluten strands, which softs the crumb and extends shelf-life. Sugar is not just a sweetener; it also acts as a primary reactant in crust-browning Maillard reactions.

93. (D) Saccharomyces cerevisiae
Saccharomyces cerevisiae, commonly known as baker's yeast, is the primary biological leavening agent used in commercial bread making. This single-celled fungus metabolizes simple sugars in the dough under aerobic and anaerobic conditions, producing carbon dioxide gas and ethanol. The trapped carbon dioxide gas expands the gluten network, causing the dough to rise and develop a light crumb structure.

94. (A) Both A and R are true and R is the correct explanation of A.
Omitting salt from a bread formulation negatively affects both yeast activity and dough rheology. Salt exerts osmotic pressure that slows yeast fermentation, ensuring controlled gas production. Additionally, ionic sodium and chloride ions interact with gluten proteins, shielding electrical charges and allowing protein chains to align closely. This interaction strengthens the gluten network, reducing stickiness.

95. (B) Oven spring refers to rapid initial dough expansion in the oven due to gas expansion.
During the early stages of bread baking, the sudden application of heat causes a rapid rise in volume known as oven spring. This expansion occurs because gases expand, water vaporizes into steam, and yeast activity increases before the yeast is killed at fifty-five degrees Celsius. Starch gelatinization and protein coagulation subsequently set the crumb structure.

96. (D) P-III, Q-I, R-II, S-IV
Bread defects are linked to specific formulation or process errors. A dense crumb with low volume points to yeast failure or dead yeast. An overly dark crust results from excessive sugar in the recipe. Large, irregular holes are caused by over-proofing the dough, and blisters on the crust indicate excessive moisture or condensation during baking.

Click Here to Buy book on Amazon

97. (A) Hard water minerals weaken the gluten network and cause dough collapse.
Water is a critical solvent in bread making, essential for hydrating gliadin and glutenin to form gluten. Moderately hard water actually benefits dough structure because divalent ions like calcium and magnesium strengthen the gluten network by forming ionic cross-links. Conversely, soft water can result in sticky, weak doughs that are prone to collapse.

98. (C) The Windowpane test
The windowpane test is a practical method used by bakers to evaluate gluten development during kneading. A small piece of dough is gently stretched from the center. If the dough can be stretched into a thin, translucent membrane without tearing, it indicates that the glutenin and gliadin proteins have formed a fully developed, strong, and elastic network.

99. (A) Globulin - Structural gas-holding network backbone
The structural, gas-holding backbone of bread dough is formed exclusively by the gluten complex, which is composed of hydrated gliadin and glutenin. Globulins and albumins are soluble wheat proteins that do not contribute directly to the visco-elastic gluten network. Gliadin provides dough extensibility, while glutenin provides elasticity and resistance to deformation.

100. (D) Chorleywood Bread Process (CBP) - Relies on prolonged bulk fermentation (4-6 hours) instead of mechanical development
The Chorleywood Bread Process is a modern bread-making method that completely eliminates prolonged bulk fermentation. Instead, it relies on high-speed mechanical mixing to develop the gluten network in minutes. This process utilizes chemical oxidants and enzymes to speed up dough development, saving significant time and space compared to traditional fermentation methods.

101. (B) Strengthening the gluten network via disulfide bonds.
Sugar serves several functional roles in bread dough, including acting as a fermentable carbohydrate for yeast, enhancing crust color via browning reactions, and retaining moisture to extend shelf-life. However, sugar does not strengthen the gluten network; in fact, high sugar concentrations can weaken gluten structure by competing with proteins for water hydration.

NODIA

102. (D) Statement I is false but Statement II is true
Bread staling is often mistaken for simple drying, but it is actually a complex physicochemical process. The primary driver of staling is starch retrogradation, which is the recrystallization of amylopectin molecules that were gelatinized during baking. This structural rearrangement occurs even in hermetically sealed containers where no moisture loss to the environment has taken place.

103. (D) Increase the amount of hydration (water).
Gluten proteins, specifically gliadin and glutenin, require water to hydrate and form a visco-elastic network. High-gluten flour contains a higher concentration of these proteins than standard flour. Consequently, substituting standard flour with a high-gluten flour requires increasing the water content of the recipe to ensure proper protein hydration and optimal dough consistency.

104. (A) Over-proofing caused the gluten network to rupture.
Over-proofing occurs when bread dough is fermented for too long, allowing yeast to produce excessive carbon dioxide. This gas buildup overstretches the gluten network past its elastic limit, causing it to weaken and rupture. During baking, the weakened structure collapses, resulting in a low-volume loaf with an irregular crumb and large, uneven air pockets.

105. (B) Moistens surface - allows maximum oven spring - gelatinizes starch for crisp crust.
Injecting steam into the oven during the initial stage of baking has a critical physical effect on crusty breads. The steam condenses on the cold dough surface, keeping it moist and flexible. This moisture prevents premature crust setting, allowing maximum oven spring. Furthermore, the water assists in starch gelatinization, which dries into a thin, crisp, and glossy crust.

106. (B) Mixing solid fat and sugar to entrap air before adding liquid ingredients.
The creaming method is a fundamental preparation technique used in cake and cookie making. It involves beating solid fat, such as butter or shortening, with crystalline sugar. The sharp sugar crystals cut into the fat, trapping thousands of tiny air bubbles. This physical aeration is critical for providing structure and rise to the baked product.

107. (A) 1, 2, and 4
Biscuit and cookie manufacturing relies on precise gluten control. Hard sweet biscuits require developed gluten to withstand sheeting, while short doughs use high fat and sugar levels to prevent gluten formation, ensuring a crumbly texture. Ammonium bicarbonate is a valuable leavening agent because it decomposes completely into gases at high baking temperatures, leaving no residue.

108. (C) Ammonium bicarbonate
Ammonium bicarbonate is highly favored in low-moisture biscuit and cracker manufacturing because of its unique thermal decomposition properties. When heated above sixty degrees Celsius, it breaks down completely into carbon dioxide, ammonia gas, and water vapor. Since no solid salts are left behind, it does not affect the final pH, flavor, or color of the product.

109. (A) Both A and R are true and R is the correct explanation of A.
High-ratio cakes contain more sugar than flour, which can weaken the batter structure. Using chlorinated flour helps solve this problem. Chlorination modifies starch granules, lowering their gelatinization temperature and increasing their water-holding capacity. This allows the starch to set quickly during baking, supporting the high levels of sugar and liquid without structural collapse.

110. (C) Lamination; during baking, water vaporizes and expands between dough-fat layers.
Puff pastry achieves its dramatic rise through lamination rather than chemical or biological leavening. This process involves folding layers of fat between layers of dough. During baking, the intense heat causes water in the dough to vaporize into steam. This steam expands, pushing the dough layers apart, while the melting fat creates barriers that trap the steam.

111. (B) P-II, Q-IV, R-III, S-I
Cake defects are directly related to recipe or baking deviations. A cake sinks in the middle if it contains too much sugar or is under-baked. A tough, rubbery texture results from over-mixing, which overdevelops gluten. A pale color indicates a low oven temperature, and a peaked, cracked center is caused by an excessively high oven temperature.

112. (D) Lowering the pH of the cookie dough typically increases browning during baking.
In cookie manufacturing, the Maillard reaction is highly dependent on pH. Lowering the dough pH, which makes it more acidic, actually slows down the Maillard reaction and reduces surface browning during baking. Conversely, raising the pH by adding alkaline agents like sodium bicarbonate accelerates Maillard browning, leading to a darker, more colorful crust.

NODIA

113. (A) To relax gluten and keep the laminating fat solid, preventing melting.
Resting puff pastry dough under refrigeration between folding turns serves two key functions. First, the cold temperature keeps the laminating fat solid, preventing it from melting and blending into the dough layers. Second, the rest period allows the gluten network to relax, reducing elasticity so the dough can be sheeted without tearing or shrinking.

114. (C) Emulsification - Disperses fat and water uniformly in the cake batter
In cake making, emulsification is the process of dispersing shortening fat and liquid ingredients into a uniform, stable mixture. Emulsifiers reduce interfacial tension, allowing tiny air bubbles to be held within the fat phase. This stable dispersion is critical for preventing batter separation, which ensures a uniform crumb structure and high volume in the finished cake.

115. (A) Zone 4 (Gelatinization) - Maximum swelling of starches post-baking
A tunnel oven for baking biscuits is divided into distinct thermal zones. Starch gelatinization occurs early in the oven, primarily in the initial heating and development zones, rather than at the end of the baking process. The final zones of the oven are dedicated to moisture removal, structure setting, and browning via Maillard reactions and caramelization.

116. (D) Magnetic (induction raising))
Aeration in bakery products is achieved through three established methods. Biological aeration uses yeast fermentation to generate carbon dioxide. Chemical aeration relies on baking powders to release gas. Mechanical aeration traps air during mixing, creaming, or laminating. Magnetic induction is a heating method, not a physical or chemical mechanism for introducing gas into batters or doughs.

CHAPTER 16
Processing of Animal-Based Foods

1. What is the average specific gravity of normal whole cow milk at 15.5 °C?
(A) 1.015 to 1.020
(B) 1.028 to 1.032
(C) 1.036 to 1.040
(D) 1.045 to 1.050

2. Consider the following statements regarding the physicochemical properties of milk:
I. The pH of normal fresh cow milk ranges between 6.5 and 6.7.
II. The freezing point of milk is generally higher than that of pure water.
III. Boiling point of milk is slightly higher than 100 °C at sea level.
IV. Titratable acidity of fresh milk is entirely due to the presence of lactic acid.
Which of the statements given above are correct?
(A) I and III only
(B) I, II, and III only
(C) II and IV only
(D) I, III, and IV only

3. Which of the following statements regarding the standardisation of milk is incorrect?
(A) Skim milk is often added to whole milk to increase the overall fat percentage.
(B) Standardisation involves adjusting the fat and solid-not-fat (SNF) percentages to meet legal requirements.
(C) Pearson's square method is a mathematical tool commonly used for milk standardisation.
(D) Centrifugal separators are used to separate cream from skim milk during this process.

4. Match the dairy processing enzymes/proteins in List I with their primary characteristics/ functions in List II.
List I: (Dairy processing enzymes/proteins)
P. Alkaline phosphatase
Q. Lipase
R. Casein
S. Whey proteins
List II: (Primary characteristics/functions)
I. Highly heat-sensitive proteins that do not coagulate with rennet
II. Indicator enzyme used to check the efficiency of pasteurisation
III. Enzyme responsible for hydrolytic rancidity in raw milk
IV. Major protein fraction that precipitates at pH 4.6
(A) P-II, Q-III, R-IV, S-I
(B) P-III, Q-II, R-IV, S-I
(C) P-II, Q-IV, R-I, S-III
(D) P-IV, Q-III, R-I, S-II

5. Which of the following is the correctly matched pair regarding milk pasteurisation time-temperature combinations?
(A) High Temperature Short Time (HTST) – 72 °C for 15 seconds
(B) Low Temperature Long Time (LTLT) – 63 °C for 15 minutes
(C) Ultra-High Temperature (UHT) – 100 °C for 30 minutes
(D) Standard Thermisation Treatment – 85 °C for 5 seconds

6. Read the given statements and select the correct option:
Statement I: Homogenisation reduces the size of fat globules in milk to prevent the formation of a cream layer.
Statement II: Homogenised milk is more susceptible to hydrolytic rancidity if not pasteurised prior to or immediately after the process.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

7. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:

Downloaded from www.pdf.tube

fermentable sugars, which helps retard staling and improves crust color during baking.

127. (B) The specific volume of bread is measured by dividing the loaf's weight by its volume (g/cc).
Specific volume is a key quality parameter for bread, but the assertion contains a calculation error. Specific volume is actually calculated by dividing the loaf volume by its weight, expressed in cubic centimeters per gram. The inverse value, weight divided by volume, represents the density of the loaf rather than its specific volume.

128. (D) Growth of common spoilage molds
A water activity of zero point eight eight is highly conducive to the growth of xerophilic molds, such as Aspergillus and Penicillium species, which are the primary spoilage organisms for baked goods. While this water activity level is too low for most pathogenic bacteria to grow, it is ideal for molds, making them the most significant shelf-life threat.

129. (A) Ascorbic acid - Dough oxidant
Matching bakery ingredients with their correct functional class is essential. Ascorbic acid is a dough oxidant that promotes the formation of disulfide bonds, strengthening gluten. In contrast, sodium bicarbonate is a leavening agent, calcium propionate is an antimicrobial preservative, and diacetyl tartaric acid esters of mono- and diglycerides act as emulsifiers rather than anti-caking stabilizers.

130. (C) Potassium bromate - Legal bleaching agent under food safety regulations
Potassium bromate is a powerful dough oxidizer that improves gas retention and loaf volume. However, because it is a suspected carcinogen, its use is banned under food safety regulations in many countries, including India and the European Union. Therefore, identifying it as a legally permitted bleaching agent under modern food safety standards is incorrect.

131. (A) Ascorbic acid
Dough relaxers are reducing agents that break disulfide bonds in gluten to reduce elasticity. L-cysteine, sodium metabisulfite, and glutathione from inactivated yeast all serve this function. Ascorbic acid, however, acts as an oxidizing agent in the presence of oxygen, promoting disulfide bond formation and strengthening the gluten network rather than relaxing it.

132. (A) Both Statement I and Statement II are true
Rope disease is a severe bacterial spoilage of bread characterized by a sticky, stringy crumb and a distinctive odor of overripe melons. This defect is caused by heat-resistant endospores of Bacillus subtilis. These spores survive the baking process and germinate as the bread cools, producing proteolytic enzymes that break down the crumb structure.

133. (B) Mono-diglycerides for cake aeration, and DATEM for bread strength.
Emulsifier selection depends on the target food structure. In low-fat cakes, mono- and diglycerides stabilize the air-fat-water interface, helping to aerate the batter and ensure a light texture. For high-volume crusty bread, diacetyl tartaric acid esters of mono- and diglycerides interact with gluten proteins to strengthen the dough network, maximizing gas retention and volume.

134. (C) Slicing and packaging the bread while warm, creating condensation.
Slicing and packaging bread while it is still warm is a common cause of mold spoilage. Warm bread releases moisture vapor, which condenses on the cold inner surface of the packaging film. This condensation creates localized areas of high water activity on the crust, allowing mold spores to overcome the preservative effects of calcium propionate.

135. (D) Over-strengthened tight gluten → low volume.
Overdosing bread dough with a strong oxidizing agent like ascorbic acid causes excessive disulfide cross-linking within the gluten network. This over-oxidation makes the dough extremely tight, rigid, and resistant to extension. During fermentation and baking, the rigid gluten network cannot expand under gas pressure, resulting in a dense crumb and low loaf volume.

136. (A) Enzymatic conversion of starch in malted barley to sugars in warm water.
Mashing is a critical biochemical step in beer production. It involves mixing crushed malted barley with warm water under controlled temperatures. This process activates natural amylase enzymes, which hydrolyze insoluble grain starches into soluble sugars, primarily maltose. The resulting sweet liquid, known as wort, is then separated and boiled with hops before fermentation.

NODIA

temperature post-pasteurisation.
(B) Ensuring adequate residence time of milk within the holding tube.
(C) Validation of the fat and solid-not-fat standardisation efficiency.
(D) Meeting the legal minimum pasteurisation temperature requirement.

16. What is the standard minimum time-temperature requirement for Ultra-High Temperature (UHT) processing of milk?
(A) 100 °C to 115 °C for 10 to 15 seconds
(B) 121 °C to 125 °C for 15 to 20 minutes
(C) 135 °C to 150 °C for 1 to 8 seconds
(D) 110 °C to 120 °C for 20 to 30 seconds

17. Consider the following statements regarding aseptic packaging of UHT milk:
I. Hydrogen peroxide is commonly used for the chemical sterilisation of packaging materials.
II. Aluminum foil in the aseptic carton acts as a barrier against light and oxygen.
III. The filling of UHT milk into cartons must be done in a highly sterile environment.
IV. Aseptic cartons typically have a single layer composed entirely of food-grade polyethylene.
Which of the statements given above are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I and III only
(D) I, II, III, and IV

18. Which of the following statements about UHT processed milk is incorrect?
(A) UHT milk can be stored at room temperature for several months if left unopened.
(B) UHT processing systems rely primarily on direct or indirect heating methods.
(C) Aseptic packaging is a mandatory requirement to maintain UHT milk commercial sterility.
(D) UHT milk is completely sterile and free of any active spores or enzymes.

19. Match the UHT processing equipment in List I with their functions in List II.
List I: (UHT processing equipment)
P. Steam injector
Q. Tubular heat exchanger
R. Flash vessel
S. Holding tube
List II: (Functions)
I. Provides the exact residence time for commercial sterilisation
II. Removes added water and cools the milk rapidly via vacuum
III. Uses indirect heat transfer for heating or cooling
IV. Introduces culinary steam directly into the milk for rapid heating
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-II, R-III, S-I
(D) P-I, Q-III, R-II, S-IV

20. Which of the following is the correctly matched pair regarding milk heat treatments?
(A) Direct UHT processing – Systems utilizing plate heat exchangers
(B) Indirect UHT processing – Systems utilizing direct steam infusion
(C) Thermisation – Mild heating to temporarily extend raw milk storage
(D) In-container sterilisation – Intense heating at 135 °C for 2 seconds

21. Read the given statements and select the correct option:
Statement I: Direct UHT heating methods (injection and infusion) result in less thermal damage to milk compared to indirect methods.
Statement II: Indirect heating methods rely on a physical barrier between the heating medium and the milk, resulting in a slower heat transfer rate.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

22. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): In the direct UHT processing of milk, a flash cooling step using a vacuum chamber is essential immediately after the holding tube.
Reason (R): Flash cooling instantaneously removes the exact amount of water that was added as condensed steam during the direct heating phase.
(A) Both A and R are true and R is the correct explanation of A.

Click Here to Buy book on Amazon

147. (A) Both Statement I and Statement II are true
Red wine must is typically fermented at higher temperatures than white wine, usually between twenty and thirty degrees Celsius. This warmth is necessary to extract anthocyanin pigments and tannins from the grape skins, which are left in the fermentation tank. White wine is fermented at lower temperatures to preserve delicate, volatile fruit aromas.

148. (D) It acts as both an antioxidant and an antimicrobial agent in the wine.
Sulfur dioxide is a widely used preservative in winemaking because of its dual action. It acts as an antioxidant, scavenging free oxygen to prevent browning and flavor loss, and as an antimicrobial agent, inhibiting wild yeasts and spoilage bacteria. This selective action allows cultivated wine yeasts to carry out fermentation without microbial competition.

149. (B) Chill haze caused by the cross-linking of proteins and polyphenols at low temperatures.
Chill haze is a physical defect in beer that appears only at cold temperatures. It is caused by non-covalent bonding between barley proteins and hop polyphenols when cooled to near-zero temperatures. Because this bonding is reversible, warming the beer to room temperature breaks the weak physical bonds, allowing the haze to dissolve and restoring clarity.

150. (C) It alters flavor and creates a thicker, darker brew due to soluble extractives.
Adulterating pure roasted coffee with undeclared roasted chicory root significantly changes the quality of the beverage. Chicory root contains high levels of water-soluble inulin, which caramelizes during roasting. This high solubility increases the yield of soluble extractives, resulting in a brew that is physically thicker, darker in color, and distinctly different in flavor.

NODIA

137. (B) 1, 2, and 3
Wine production relies on specific processing steps. Crushing releases the juice, while fermenting red grapes with their skins extracts color-giving anthocyanins and bitter tannins. Racking siphons clear wine away from settled yeast debris. Malolactic fermentation is not used to increase acidity; instead, it converts sharp malic acid into softer lactic acid, reducing sourness.

138. (B) Ethanol has a lower boiling point than water, allowing selective vaporization.
The distillation of spirits relies on the difference in boiling points between ethanol and water. At standard atmospheric pressure, ethanol boils at seventy-eight degrees Celsius, while water boils at one hundred degrees Celsius. Heating a fermented mixture to an intermediate temperature vaporizes ethanol preferentially, which is then condensed to yield a high-alcohol distillate.

139. (A) Both A and R are true and R is the correct explanation of A.
Hops are boiled with the liquid wort during beer brewing for several reasons. The heat isomerizes alpha-acids in the hops, creating soluble compounds that impart a pleasant bitterness to balance the sweet malt sugars. Additionally, hops release essential oils that contribute characteristic floral aromas and contain natural polyphenols that act as antimicrobial preservatives.

140. (C) Steeping, germinating, and kilning barley to develop starch-degrading enzymes.
Malting is a controlled three-step process designed to prepare barley for brewing. First, raw grain is steeped in water to raise moisture. It is then allowed to germinate, which synthesizes starch-degrading alpha- and beta-amylase enzymes. Finally, the germinated grain is dried and roasted during kilning to halt growth while preserving active enzymes and developing flavors.

141. (D) P-III, Q-IV, R-I, S-II
Distilled spirits are defined by their unique agricultural raw materials. Rum is distilled from fermented sugarcane molasses or fresh juice. Bourbon whiskey must be produced from a grain mash containing at least fifty-one percent corn. Brandy is distilled from fermented fruit juice, typically grape wine, and tequila is produced from the blue agave plant.

142. (C) Argemone oil is a common, legal clarifying agent used in premium wines.
Argemone oil is a highly toxic oil extracted from the seeds of Argemone mexicana, which causes epidemic dropsy and is strictly banned as a dangerous food adulterant. It is never used as a clarifying agent in wine production. Wine clarification instead utilizes safe, approved fining agents such as bentonite, gelatin, egg albumin, or silica sol.

143. (B) Methanol
Methanol is a highly dangerous chemical contaminant found in poorly distilled illicit spirits. During metabolism, liver enzymes oxidize methanol into formaldehyde and highly toxic formic acid. This acid accumulates, causing metabolic acidosis and selective damage to the optic nerve, which can lead to permanent blindness or death, making it a critical screening target.

144. (D) Cork taint in wine - 2,4,6-Trichloroanisole (TCA)
Cork taint is a widespread wine defect that causes a damp, musty, or cardboard-like off-flavor. This defect is caused by the chemical compound 2,4,6-trichloroanisole, which is produced when naturally occurring cork fungi metabolize chlorophenols found in wood sanitizers. In contrast, chill haze in beer is caused by protein-polyphenol complexes, not hop bitterness.

145. (A) Isoamyl acetate - Cardboard or wet paper flavor, from severe oxidation
Isoamyl acetate is an ester that provides a pleasant, fruity, banana-like aroma in beer, not a cardboard-like off-flavor. The cardboard or wet paper defect is caused by trans-2-nonenal, which is produced through lipid oxidation during storage. Other off-flavors are correctly matched, including buttery diacetyl from microbial contamination and DMS from thermal malt precursors.

146. (C) Mead
Distilled spirits are alcoholic beverages produced by distilling fermented mixtures to increase ethanol concentration. Gin, vodka, and rum are all distilled spirits. Mead, however, is a non-distilled, fermented beverage made from honey, water, and yeast, with an alcohol content similar to wine, placing it outside the classification of distilled spirits.

Downloaded from www.pdf.tube

Assertion (A): The alkaline phosphatase test is universally used to verify the adequacy of High Temperature Short Time (HTST) pasteurisation.
Reason (R): The alkaline phosphatase enzyme is inherently present in raw milk and its thermal inactivation curve closely parallels that of Coxiella burnetii.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

8. A dairy processing plant notices that their freshly pasteurised milk is spoiling prematurely within two days under refrigeration. Laboratory tests show high numbers of psychrotrophic bacteria but no coliforms. What is the most likely cause of this issue?
(A) Inadequate holding time during the HTST pasteurisation.
(B) Excessive water addition during the standardisation phase.
(C) Post-pasteurisation contamination from the cooling plates.
(D) Incomplete or faulty homogenisation prior to packaging.

9. All of the following are primary objectives of pasteurising milk, except:
(A) Total eradication of all pathogenic microorganisms.
(B) Extension of the keeping quality and overall shelf life.
(C) Inactivation of natural spoilage enzymes like lipase.
(D) Complete destruction of all bacterial endospores.

10. Arrange the standard steps of commercial fluid milk processing in the correct sequential order:
1. Standardisation
2. Clarification
3. Homogenisation
4. HTST Pasteurisation
5. Chilling and Packaging

(A) 2, 1, 3, 4, 5
(B) 1, 2, 4, 3, 5
(C) 2, 3, 1, 4, 5
(D) 1, 4, 2, 3, 5

11. According to FSSAI standards, what defines "Toned Milk"?
(A) Milk obtained by mixing buffalo milk with cow milk, containing minimum 4.5% fat and 8.5% SNF.
(B) Milk prepared by admixing whole milk with skim milk, containing minimum 3.0% fat and 8.5% SNF.
(C) Milk from which part of the fat has been removed, containing minimum 1.5% fat and 9.0% SNF.
(D) Recombined milk prepared with added milk fats, containing minimum 6.0% fat and 9.0% SNF.

NODIA

12. Identify the correct statement regarding the physical structure of milk.
(A) Milk fat exists as a stable colloidal dispersion.
(B) Lactose and whey proteins are present in true solution.
(C) Casein micelles are completely dissolved in the aqueous phase.
(D) Calcium phosphate exists entirely in a soluble state in milk.

13. Which of the following is the most appropriate indicator of proper homogenisation in a commercial milk sample?
(A) Absence of a visible cream layer after 48 hours of storage.
(B) A noticeable increase in the titratable acidity after storage.
(C) Complete inactivation of naturally occurring protease enzymes.
(D) A significant increase in the freezing point depression value.

14. If a dairy technologist aims to produce Double Toned Milk, they must adjust the fat and SNF to specific legal minimums. Based on standard regulations, what is the required calculation target for Double Toned Milk?
(A) Minimum 1.5% fat and 9.0% SNF
(B) Minimum 3.0% fat and 8.5% SNF
(C) Minimum 4.5% fat and 8.5% SNF
(D) Minimum 0.5% fat and 8.7% SNF

15. As a Food Safety Officer auditing a dairy plant, you notice the HTST flow diversion valve is operating erratically, sometimes allowing milk at 70 °C to pass forward. Which critical food safety competency is compromised here?
(A) Verification of the continuous chilling

117. (A) Both Statement I and Statement II are true
Short dough biscuits require a tender, crumbly texture, which is achieved by minimizing gluten development. High levels of fat and sugar act as effective tenderizers. Fat coats the flour particles, creating a physical barrier that prevents water from reaching the gliadin and glutenin proteins, thereby restricting their hydration and subsequent cross-linking into a gluten network.

118. (C) By stabilizing the foam with sugar and folding fat gently to preserve air cells.
Egg foam is a delicate structure that can easily collapse when lipids are introduced, as fat disrupts the protein film surrounding the air bubbles. To prevent this, the foam should be stabilized with sugar, which increases its viscosity. The melted butter must then be folded in gently, minimizing mechanical shear to preserve the trapped air cells.

119. (D) Over-mixing and excessive scrap reuse leading to over-developed gluten.
Hard-sweet biscuits like Marie require a delicate balance of dough strength and extensibility. If the dough is over-mixed or if too much recycled scrap dough is added back into the batch, the gluten network becomes over-developed and elastic. This excess elasticity causes the dough to shrink during sheeting, resulting in tough, hard, and misshapen biscuits.

120. (A) Coarse sugar → slow dissolution → late syrup volume increase → excessive spread.
Sugar particle size directly influences cookie spread during baking. Coarse sugar crystals dissolve slowly in the dough. As the oven temperature rises, the sugar continues to dissolve, increasing the volume of liquid syrup late in the baking process. This late increase in liquid phase reduces dough viscosity, allowing the cookie to spread excessively before structure sets.

121. (B) A mix of enzymes, emulsifiers, and oxidants that improves dough performance.
A dough improver is a functional blend of food additives used in commercial baking to optimize dough handling and bread quality. These mixtures typically contain enzymes to generate sugars, emulsifiers to strengthen gluten and soften the crumb, and oxidants to improve gas retention. Their combined action ensures uniform loaf volume, crumb structure, and shelf-life stability.

122. (B) 1, 2, and 3
Emulsifiers are essential functional additives in modern baking. Sodium stearoyl lactylate strengthens gluten and softs the crumb, while diacetyl tartaric acid esters of mono- and diglycerides improve gas retention in crusty or frozen doughs. Lecithin aids in fat dispersion. Emulsifiers act by stabilizing interfaces, not by directly accelerating the biological fermentation rate of yeast.

123. (A) Maltogenic alpha-amylase
Maltogenic alpha-amylase is a specialized enzyme added to bread formulations to delay staling. During baking, this enzyme hydrolyzes starch molecules, specifically modifying amylopectin recrystallization pathways. By shortening amylopectin chains, it prevents tight retrogradation as the bread cools. This enzymatic modification keeps the crumb soft and elastic, extending the shelf-life of the bread.

124. (A) Both A and R are true and R is the correct explanation of A.
Calcium propionate is a widely used preservative in commercial bread making. It functions as an effective antimicrobial agent, specifically targeting mold spores and rope-producing bacteria like Bacillus subtilis. Because the active propionic acid is most effective in slightly acidic doughs and does not inhibit baker's yeast, it provides excellent shelf-life protection without interfering with fermentation.

125. (D) Texture Profile Analyzer (TPA) measures crumb firmness and elasticity.
Quality control in baking relies on objective measurements. A Texture Profile Analyzer is a standard instrument used to evaluate crumb firmness, springiness, and chewiness by simulating human biting forces. Conversely, freshly baked bread has a high moisture content of around forty percent, and its water activity is near zero point nine five, which requires preservation.

126. (C) P-III, Q-I, R-II, S-IV
Enzymes serve specific biochemical functions in bakery products. Proteases relax strong gluten to reduce mixing times. Hemicellulases break down pentosans to improve dough extensibility. Lipoxygenases oxidize carotenoid pigments to bleach flour and strengthen gluten, and alpha-amylases hydrolyze starches to produce

Click Here to Buy book on Amazon

(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

23. A batch of aseptically packaged UHT milk exhibits a bitter taste and gelation after three months of ambient storage, despite negative microbiological culture tests. What is the most probable cause?
(A) Microbial contamination with coliforms during the aseptic filling process.
(B) Survival of heat-resistant proteases from psychrotrophic bacteria.
(C) Insufficient hydrogen peroxide concentration during carton sterilisation.
(D) Excessive homogenisation pressures that cause rapid fat coalescence.

24. All of the following are recognized methods for sterilising packaging material in aseptic packaging systems, except:
(A) Hydrogen peroxide bath followed by hot air drying
(B) High-intensity ultraviolet (UV) irradiation
(C) Soaking in a 5% sodium chloride solution
(D) Treatment with gaseous chlorine dioxide

25. What is the primary cause-and-effect relationship regarding the "cooked flavor" often perceived in UHT treated milk?
(A) Caramelisation of lactose leading to the formation of pyrazines.
(B) Hydrolysis of triglycerides producing free short-chain fatty acids.
(C) Oxidation of ascorbic acid generating various off-flavor compounds.
(D) Denaturation of whey proteins releasing volatile sulfhydryl compounds.

26. Which of the following best defines "commercial sterility" as applied to UHT milk?
(A) The absence of microorganisms capable of growing under normal non-refrigerated storage.
(B) The complete absence of all living microorganisms, including all viruses and prions.
(C) The reduction of the total viable bacterial load by precisely 5 log cycles.
(D) The elimination of only pathogenic bacteria, leaving spoilage organisms intact.

27. Identify the correct statement regarding aseptic packaging materials for dairy products.
(A) Glass bottles are the most commonly used packaging for continuous aseptic filling due to their flexibility.
(B) Ethylene Vinyl Alcohol (EVOH) can be used as an oxygen barrier layer in co-extruded plastic aseptic bottles.
(C) The paperboard layer in a typical aseptic carton provides structural rigidity but offers no barrier to oxygen.
(D) The innermost layer of an aseptic carton in contact with the milk is usually made of aluminum foil.

28. Which of the following is the most appropriate reason for using an aseptic surge tank between the UHT steriliser and the packaging machine?
(A) To provide additional holding time to ensure complete thermal destruction of spores.
(B) To act as a buffer and maintain continuous steriliser operation during packaging stops.
(C) To rapidly cool the milk down from high temperatures to packaging temperatures.
(D) To thoroughly mix the sterile milk with stabilising agents post-sterilisation.

29. In a UHT processing plant, if the flow rate of milk increases unexpectedly due to a faulty timing pump, how will this primarily impact the safety of the final product?
(A) The holding time decreases, failing to achieve commercial sterility.
(B) The milk will become overly concentrated due to excessive evaporation.
(C) The homogenisation efficiency of the system will improve drastically.
(D) The milk will experience severe Maillard browning due to heat shock.

30. As a Food Safety Officer, when inspecting the records of a UHT aseptic packaging line, which critical parameter log indicates successful chemical sterilisation of the packaging web?
(A) Operating pressure and performance of the homogeniser.
(B) Direct temperature readings of the flash cooling vessel.
(C) Hydrogen peroxide bath concentration and temperature.
(D) Speed controls of the packaging machine conveyor belt.

Downloaded from www.pdf.tube

Which of the statements given above are correct?
(A) I and III only
(B) II, III, and IV only
(C) I, II, and IV only
(D) I, II, III, and IV

63. Which of the following statements concerning sweetened condensed milk is incorrect?
(A) Sucrose is added to the milk primarily to act as a preservative by lowering the water activity.
(B) The product typically does not require final commercial sterilisation in the can due to its high osmotic pressure.
(C) The standard sugar concentration in the aqueous phase of sweetened condensed milk is around 60-64.5%.
(D) Sweetened condensed milk undergoes a rigorous retort sterilisation at 121 °C for 15 minutes to ensure safety.

64. Match the anatomical structures of a hen's egg in List I with their primary functions/ characteristics in List II.
List I: (Anatomical structures of a hen's egg)
P. Chalazae
Q. Vitelline membrane
R. Cuticle (Bloom)
S. Air cell
List II: (Primary functions/characteristics)
I. Increases in size as the egg ages due to moisture loss
II. Outer protective coating of the shell that seals pores
III. Twisted cord-like structures that anchor the yolk in the center of the egg
IV. The clear membrane that directly encases and holds the yolk contents
(A) P-III, Q-IV, R-II, S-I
(B) P-IV, Q-III, R-I, S-II
(C) P-III, Q-I, R-II, S-IV
(D) P-II, Q-IV, R-III, S-I

65. Which of the following is the correctly matched pair regarding defects in milk powder?
(A) Insolubility index – Indicates total thermal denaturation of key whey proteins
(B) Maillard browning – High temperature and moisture during storage
(C) Free fat accumulation – Excessive vacuum applied during the evaporation stage
(D) Scorched particles – Low inlet air temperatures within the spray drying chamber

66. Read the given statements and select the correct option:
Statement I: Whole milk powder has a significantly shorter shelf life than skimmed milk powder when stored under ambient conditions.
Statement II: The higher fat content in whole milk powder makes it highly susceptible to lipid oxidation and the development of oxidative rancidity.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

NODIA

67. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Roller drying of milk generally produces a powder with a lower solubility index compared to spray drying.
Reason (R): Roller drying subjects the concentrated milk to direct contact with highly heated rotating drums, causing greater protein denaturation.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

68. A shipment of sweetened condensed milk exhibits a defect known as "sandiness." This defect is detected as a rough, gritty sensation on the palate. What is the fundamental cause of this defect?
(A) Rapid crystallisation of sucrose caused by improper mixing.
(B) Coagulation of casein proteins due to excessively high acidity.
(C) Large lactose crystals from improper cooling and lack of seeding.
(D) Direct precipitation of calcium phosphate salts in the product.

69. All of the following are major proteins found in egg albumen (egg white), except:

process, what is the most likely error that occurred during production?
(A) Too little addition of rennet enzyme during coagulation.
(B) Maintaining a cooking temperature that was far too low.
(C) Inadequate physical pressing of the separated cheese curds.
(D) Excessive acid development before draining off the whey.

39. All of the following are primary purposes of cutting the coagulated curd during cheese making, except:
(A) To significantly increase the surface area of the curd.
(B) To distribute salt evenly throughout the matrix.
(C) To facilitate rapid expulsion of whey via syneresis.
(D) To control the moisture content of the final cheese.

40. Arrange the following processes of typical yoghurt manufacture in the correct sequential order:
1. Homogenisation of milk
2. Pasteurisation at 85-90 °C for 15-30 minutes
3. Cooling to 42-45 °C
4. Inoculation with starter cultures
5. Incubation and final cooling

(A) 1, 2, 3, 4, 5
(B) 2, 1, 4, 3, 5
(C) 1, 3, 2, 4, 5
(D) 2, 3, 1, 4, 5

41. What is the precise definition of "cheddaring" in the context of cheese manufacture?
(A) The physical process of pressing cheese curds into specific cylindrical metal molds.
(B) The manual application of dry salt directly to the outer surface of the cheese wheel.
(C) The exact period of time the finished cheese spends aging within the ripening cave.
(D) Stacking and turning warm curd blocks to promote drainage and acid development.

42. Identify the correct statement regarding the role of calcium in cheese coagulation.
(A) Soluble calcium is required for para-casein micelle aggregation.
(B) Calcium ions actively inhibit the proteolytic action of chymosin.
(C) Commercial addition of calcium chloride is strictly prohibited.
(D) Calcium reduces syneresis during the cooking phase of curds.

43. Which of the following is the most appropriate reason for applying a significantly higher heat treatment (e.g., 90 °C for 5 mins) to milk intended for yoghurt compared to fluid milk?
(A) To completely caramelise the lactose sugars to produce a sweeter taste.
(B) To denature whey proteins so they interact with casein to form a firmer gel.
(C) To destroy all thermophilic bacterial spores that survive standard pasteurisation.
(D) To rapidly reduce the natural pH level of the milk prior to starter inoculation.

44. A dairy technologist observes that a fermentation vat of yoghurt has stalled at a pH of 5.8 after 4 hours of incubation at 43 °C. What is the most plausible scientific explanation for this phenomenon?
(A) The incubation temperature of 43 °C was lethal to Streptococcus thermophilus.
(B) The milk contained residual antibiotics that inhibited starter culture growth.
(C) The milk was excessively homogenised, preventing normal acid formation.
(D) An excessively high amount of starter culture was inoculated initially.

45. During an inspection of a cheese manufacturing facility, a Food Safety Officer must verify the critical limits for the pasteurisation of cheese milk. If the facility uses raw milk for making a hard cheese, what is the mandatory safety requirement according to broad international food safety standards?
(A) Aging the cheese at above 1.7 °C for a minimum of 60 days.
(B) Ripening the cheese at ambient temperature for at least 60 days.
(C) Treating the raw milk with hydrogen peroxide prior to renneting.
(D) Subjecting the finished cheese to high-dose ultraviolet radiation.

46. What is the typical legal minimum percentage of milk fat required in commercial table butter according to standard FSSAI regulations?
(A) 70%
(B) 80%

Click Here to Buy book on Amazon

(C) 85%
(D) 90%

47. Consider the following statements regarding the continuous churning process in butter production:
I. Cream is subjected to severe mechanical agitation to break the fat globule membrane.
II. Churning causes a phase inversion from an oil-in-water emulsion to a water-in-oil emulsion.
III. Buttermilk is the primary byproduct drained off during the churning process.
IV. Working the butter decreases moisture droplet size, improving the keeping quality.
Which of the statements given above are correct?
(A) I and II only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, II, III, and IV

48. Which of the following statements about ghee production is incorrect?
(A) Ghee is primarily produced by the clarification of butter or cream at elevated temperatures.
(B) The characteristic flavor of ghee is partly due to the production of lactones and carbonyls during heating.
(C) Ghee is an oil-in-water emulsion with a high moisture content of around 16%.
(D) The pre-stratification method is a common industrial technique used to save energy during ghee making.

49. Match the ice cream ingredients in List I with their principal functions in List II.
List I: (Ice cream ingredients)
P. Milk solids-not-fat (MSNF)
Q. Stabilisers (e.g., Guar gum)
R. Emulsifiers (e.g., Mono- and diglycerides)
S. Sweeteners
List II: (Principal functions)
I. Depress the freezing point and provide bulk
II. Improve whipping ability and promote fat destabilisation during freezing
III. Increase viscosity and prevent the formation of large ice crystals
IV. Enhance texture and provide protein for air cell structural support
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-II, R-III, S-I
(D) P-I, Q-III, R-II, S-IV

50. Which of the following is the correctly matched pair regarding defects in butter?
(A) Fishy flavor – Severe over-working of the butter.
(B) Crumbly texture – Unusually high diacetyl content.
(C) Rancidity – Excessive addition of annatto coloring.
(D) Mottling – Uneven distribution of salt and moisture.

51. Read the given statements and select the correct option:
Statement I: The freezing process in ice cream manufacture consists of a dynamic phase in the scraped-surface freezer and a static phase in the hardening room.
Statement II: Overrun in ice cream is achieved entirely during the static hardening phase when the remaining water freezes.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

NODIA

52. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Rapid hardening of packaged ice cream at extremely low temperatures (e.g., -30 °C to -40 °C) is critical for final product quality.
Reason (R): Slow freezing during the hardening phase allows water molecules to migrate and form large, coarse ice crystals, leading to a gritty texture.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

53. An ice cream manufacturer receives complaints of a "sandy" texture in their vanilla ice cream after 3 weeks of cold storage. Microscopic examination reveals hard, geometric crystals. What formulation error likely caused this defect?

(A) Excess milk solids-not-fat causing lactose crystallisation.
(B) Excessive addition of milk fat to the formulation.
(C) Use of too much liquid vanilla extract in the mix.
(D) Insufficient use of emulsifiers during processing.

54. All of the following are recognized quality standards/parameters tested for assessing the purity of ghee, except:
(A) Reichert-Meissl (RM) value
(B) Polenske value
(C) Butyro-Refractometer (BR) reading
(D) Haugh unit score

55. What is the primary cause-and-effect relationship behind the "ageing" of an ice cream mix before freezing?
(A) The mix is held at 25 °C to allow bacterial fermentation, which effects a slight tartness required for fruit flavors.
(B) The mix is held at 4 °C to crystallise fat and hydrate stabilisers, improving whipping and texture.
(C) The mix is subjected to high heat to evaporate moisture, which effects a denser final product.
(D) The mix is exposed to ultraviolet light, which effects the destruction of surviving psychrotrophs.

56. How is "overrun" technically defined in the context of ice cream manufacture?
(A) The physical amount of ice cream mix that spills over the freezer barrel during continuous freezing.
(B) The specific percentage of un-frozen water remaining in the finished ice cream at -18 °C.
(C) The percentage volume increase of ice cream over the mix volume due to air incorporation.
(D) The total weight of solid inclusions like nuts or fruits added to the product post-freezing.

57. Identify the correct statement regarding the clarification process during ghee production.
(A) It involves rapidly chilling the butter under high pressure to separate out the moisture.
(B) It requires the addition of alkaline neutralisers to saponify and remove free fatty acids.
(C) It is conducted strictly under a high vacuum at controlled room temperature conditions.
(D) Evaporating water and precipitating non-fat solids by heating, then removing them.

58. Which of the following is the most appropriate analytical test to detect the adulteration of ghee with vegetable fat (Vanaspati)?
(A) Baudouin test
(B) Phosphatase test
(C) Methylene blue reduction test
(D) Gerber test

59. An ice cream manufacturer uses 100 liters of mix to produce 180 liters of finished ice cream. What is the percentage of overrun achieved?
(A) 44.4%
(B) 55.5%
(C) 80%
(D) 180%

60. As a Food Safety Officer evaluating an ice cream facility, you find that the pasteurised mix is being aged in vats at 12 °C (54 °F) instead of the recommended 4 °C (39 °F). What is the primary food safety risk associated with this practice?
(A) Premature churning of the butterfat during the ageing process.
(B) Proliferation of pathogens in the nutrient-rich mix.
(C) Significantly reduced effectiveness of the stabiliser network.
(D) Inability to achieve the desired overrun during freezing.

61. What is the generally recommended maximum moisture content for standard Skimmed Milk Powder (SMP) to ensure long-term shelf stability?
(A) 1.5% to 2.0%
(B) 3.0% to 4.0%
(C) 6.0% to 8.0%
(D) 10.0% to 12.0%

62. Consider the following steps in the commercial production of spray-dried milk powder:
I. Pre-heating and pasteurisation of standard liquid milk
II. Vacuum evaporation to concentrate the milk to approximately 40-50% total solids
III. Atomisation of the concentrated milk into a hot air chamber
IV. Separation of dry powder particles from the exhaust air using cyclones

Downloaded from www.pdf.tube

31. Which primary enzyme is traditionally responsible for the specific proteolytic cleavage of kappa-casein, initiating the coagulation phase in cheese manufacture?
(A) Pepsin
(B) Lipase
(C) Beta-galactosidase
(D) Chymosin (Rennet)

32. Consider the following steps in the conventional manufacture of Cheddar cheese:
I. Addition of starter culture and rennet
II. Cutting of the curd
III. Cooking and pitching
IV. Milling and salting
Which of the following represents the correct sequential execution of these steps?
(A) I, II, III, IV
(B) II, I, III, IV
(C) I, III, II, IV
(D) III, I, II, IV

33. Which of the following statements regarding the ripening process of cheese is incorrect?
(A) Ripening involves the breakdown of proteins, lipids, and carbohydrates by enzymes.
(B) Hard cheeses like Parmesan require a shorter ripening period compared to soft cheeses like Brie.
(C) The temperature and humidity of the ripening room must be strictly controlled to develop specific characteristics.
(D) Lactic acid bacteria continue to play a crucial role during the early stages of ripening.

34. Match the cheese types in List I with their characteristic features/origins in List II.
List I: (Cheese types)
P. Mozzarella
Q. Roquefort
R. Swiss cheese
S. Camembert
List II: (Characteristic features/origins)
I. Internally mold-ripened with Penicillium roqueforti
II. Pasta filata (stretched curd) technique
III. Surface mold-ripened with Penicillium camemberti
IV. Characterised by "eyes" formed by Propionibacterium
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-I, S-II
(D) P-II, Q-IV, R-I, S-III

35. Which of the following is the correctly matched pair of a fermented dairy product and its primary starter culture combination?
(A) Yoghurt – Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus
(B) Kefir – Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus ONLY
(C) Acidophilus milk – Lactococcus lactis and Leuconostoc mesenteroides
(D) Cultured buttermilk – Propionibacterium freudenreichii

36. Read the given statements and select the correct option:
Statement I: The production of yoghurt involves a symbiotic relationship between Streptococcus thermophilus and Lactobacillus bulgaricus.
Statement II: Streptococcus thermophilus produces formic acid which stimulates the growth of Lactobacillus bulgaricus, while L. bulgaricus liberates amino acids stimulating S. thermophilus.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

37. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Syneresis is often considered a major defect in set yoghurt.
Reason (R): Syneresis refers to the expulsion of whey from the protein network, which can be caused by excessive incubation temperatures or mechanical agitation.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

38. A batch of commercial Cheddar cheese develops a highly crumbly and brittle texture with excessive acidity. Based on the cheese manufacturing

NODIA

(A) Phosvitin
(B) Ovalbumin
(C) Conalbumin (Ovotransferrin)
(D) Lysozyme

70. Arrange the following structural components of a hen's egg in sequence from the outermost layer to the innermost core:
1. Shell membranes (inner and outer)
2. Thin and thick albumen
3. Vitelline membrane
4. Calcareous shell
5. Germinal disc (Latebra)

(A) 4, 1, 2, 3, 5
(B) 1, 4, 2, 3, 5
(C) 4, 2, 1, 3, 5
(D) 4, 1, 3, 2, 5

71. What does the "instantization" process of milk powder entail?
(A) Treating the powder with ultraviolet light to instantly kill surface bacteria on the package.
(B) Agglomeration of particles by re-wetting and re-drying to improve water dispersion.
(C) Grinding the dry powder into ultrafine, nano-sized particles to speed up the dissolution rate.
(D) Adding chemical emulsifiers and surfactants heavily during the initial spray drying stage.

72. Identify the correct statement regarding the nutritional composition of an average whole egg.
(A) Egg white contains the vast majority of the egg's cholesterol and fat.
(B) Eggs are considered an excellent dietary source of Vitamin C.
(C) The yolk contains approximately 100% of the egg's fat and a significant portion of its protein.
(D) The carbohydrate content of an egg is extremely high, providing the majority of its caloric value.

73. Which of the following is the most appropriate method to prevent age gelation in evaporated milk (unsweetened condensed milk) during prolonged storage?
(A) Addition of relatively high concentrations of sucrose to the milk.
(B) Storing the sealed cans in a consistently warm, humid environment.
(C) Homogenising the milk under extremely low processing pressures.
(D) Adding stabilising salts like disodium phosphate before sterilisation.

74. If 10kg of skimmed milk powder (moisture 4%) is completely reconstituted with 90kg of pure water, what is the approximate total solids percentage of the resulting reconstituted milk?
(A) 8.5%
(B) 9.6%
(C) 10.0%
(D) 12.5%

75. As an FSO inspecting a spray drying facility for infant formula, you note that the inlet air temperature is unusually high, and the outlet air temperature has dropped. What immediate food safety or quality risk does this imbalance suggest?
(A) Extreme heat causing complete caramelisation of all lactose in the system.
(B) High moisture powder from incomplete drying, which encourages microbial growth.
(C) Premature agglomeration of the powder particles within the separation cyclone.
(D) An immediate and severe explosion risk due to excessively dry airborne powder.

76. In the assessment of internal egg quality, the Haugh unit is a mathematical formula based on which two physical measurements?
(A) Total egg weight and the diameter of the yolk.
(B) Egg weight and thick albumen height.
(C) Shell thickness and the size of the internal air cell.
(D) Visual yolk color score and the total egg volume.

77. Consider the following observations made during the candling of intact shell eggs:
I. The depth of the air cell is less than 3 mm.
II. The yolk outline is prominent, dark, and moves freely.
III. Blood spots and meat spots are clearly visible.
IV. The albumen appears clear and firm.

Which of these observations indicate a high-quality, fresh Grade AA/A egg?
(A) I and IV only
(B) II and III only
(C) I, II, and IV only
(D) I, III, and IV only

Click Here to Buy book on Amazon

mortis ensures maximum tenderness.
(B) Rigor mortis is characterized by the stiffening of muscles due to the irreversible cross-linking of actin and myosin.
(C) The onset of rigor mortis is accompanied by a severe depletion of ATP in the muscle cells.
(D) The accumulation of lactic acid from anaerobic glycolysis drives the pH drop during rigor mortis.

94. Match the meat processing/slaughter steps in List I with their corresponding descriptions in List II.
List I: (Meat processing/slaughter steps)
P. Stunning
Q. Exsanguination
R. Evisceration
S. Splitting
List II: (Descriptions)
I. The removal of internal organs from the carcass
II. Rendering the animal unconscious and insensible to pain prior to sticking
III. Cutting the carcass into two halves along the backbone
IV. The process of bleeding the animal by severing major neck vessels
(A) P-II, Q-IV, R-I, S-III
(B) P-IV, Q-II, R-III, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-I, Q-III, R-II, S-IV

95. Which of the following is the correctly matched pair regarding stunning methods in abattoirs?
(A) Captive bolt stunning – Primarily used for poultry
(B) Carbon dioxide (CO_2) gas stunning – Specifically used for large adult cattle
(C) Pithing – A widely accepted modern method for commercial sheep slaughter
(D) Electrical stunning – Commonly used for pigs and poultry

96. Read the given statements and select the correct option:
Statement I: The ageing (conditioning) of meat involves holding the carcass at refrigerated temperatures for several days to weeks.
Statement II: Tenderness increases during ageing due to the proteolytic action of endogenous enzymes, primarily calpains and cathepsins, on structural muscle proteins.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

97. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Electrical stimulation of beef carcasses immediately after slaughter accelerates the onset of rigor mortis and prevents cold shortening.
Reason (R): The electrical current causes muscle contractions that rapidly deplete ATP and glycogen reserves, resulting in a faster pH drop before the carcass is exposed to chilling temperatures.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

98. A beef carcass evaluated post-mortem exhibits meat that is dark in color, firm in texture, and dry on the surface (DFD meat). The ultimate pH is recorded at 6.6. What is the primary cause of this condition?
(A) Acute pre-slaughter stress causing rapid lactic acid production.
(B) An excessively fast chilling rate of the carcass post-evisceration.
(C) Over-feeding of the animal just a few hours prior to slaughter.
(D) Chronic pre-slaughter stress depleting muscle glycogen stores.

99. During post-mortem inspection by a veterinarian or Food Safety Officer, all of the following conditions typically lead to total condemnation of the carcass, except:
(A) Localized bruising on one leg.
(B) Generalized bovine tuberculosis.
(C) Acute systemic septicemia.
(D) Confirmed cutaneous or systemic anthrax.

100. Arrange the following steps of commercial cattle slaughter in the standard sequential order:

85. What is the primary cause-and-effect relationship regarding the freezing of pure, unadulterated liquid egg yolk?
(A) Protein aggregation causing irreversible gelation and a gummy texture upon thawing.
(B) Freezing ruptures the vitelline membrane, causing the yolk to mix irreversibly with any residual albumen.
(C) Freezing directly induces the Maillard reaction, turning the yolk permanently brown.
(D) Freezing prevents all enzyme activity, ensuring the yolk remains permanently liquid after thawing.

86. What is the fundamental principle of the "candling" process in the egg industry?
(A) Measuring the exact weight of each egg to sort them into sizes like Jumbo or Large.
(B) Coating the washed eggs in a thin layer of natural food-grade wax to extend shelf life.
(C) Testing the shell eggs for the presence of pathogenic Salmonella using UV fluorescence.
(D) Passing eggs over a bright light source to visually inspect internal quality and cracks.

87. Identify the correct statement regarding the production of dried egg powder.
(A) Egg powder is typically manufactured using freeze-drying rather than spray drying for economic reasons.
(B) Desugarised egg white powder has excellent, long-term ambient storage stability.
(C) Liquid eggs are typically held at 37 °C for 24 hours to ferment prior to drying.
(D) Spray drying of whole eggs completely destroys all of their original nutritional value.

88. Which of the following is the most appropriate proactive measure implemented at the farm level to minimize the risk of Salmonella Enteritidis contaminating the internal contents of intact shell eggs?
(A) Washing eggs vigorously with a strong chlorine solution post-lay.
(B) Pasteurising intact shell eggs using high-pressure processing.
(C) Vaccination of laying flocks and strict biosecurity.
(D) Storing the eggs at exactly 10 °C immediately after collection.

NODIA

89. A flock of laying hens is aging, and the environmental temperature in the poultry house is consistently above 35 °C. Based on food science principles, how will these variables most likely affect the Haugh unit scores of the freshly laid eggs?
(A) The Haugh unit scores will increase, indicating thicker albumen.
(B) The Haugh unit scores will remain completely unaffected by heat.
(C) The Haugh unit measurement will become impossible to calculate.
(D) The scores will decrease, indicating thinner albumen.

90. As a Food Safety Officer evaluating a commercial liquid egg pasteurisation facility, you note that whole egg is being pasteurised at 60 °C for 3.5 minutes. What is the primary target pathogen this specific time-temperature parameter is designed to eliminate?
(A) Salmonella species
(B) Clostridium botulinum spores
(C) Listeria monocytogenes
(D) Staphylococcus aureus enterotoxin

91. What is the typical ultimate pH of normal mammalian meat (e.g., beef) after the completion of rigor mortis?
(A) 7.0 - 7.2
(B) 6.5 - 6.8
(C) 5.4 - 5.7
(D) 4.0 - 4.5

92. Consider the following observations made during the ante-mortem inspection of animals at a slaughterhouse:
I. Normal resting posture and clear breathing.
II. Profuse salivation and vesicular lesions on the snout and hooves.
III. Emaciation and severe lethargy.
IV. Bright, alert eyes and responsive behavior.
Which of these observations are definitive grounds for isolating the animal as a "suspect" or condemning it?
(A) I and IV only
(B) II and III only
(C) I, II, and III only
(D) III and IV only

93. Which of the following statements regarding rigor mortis in meat is incorrect?
(A) Deboning and freezing meat before rigor

78. Which of the following statements regarding the commercial storage of shell eggs is incorrect?
(A) Eggs should ideally be stored at temperatures between -1 °C and +1 °C to maximize shelf life.
(B) A higher relative humidity (70-80%) is required to minimize moisture loss and enlargement of the air cell.
(C) Relative humidity in the egg storage room should be kept low (around 40%) to prevent mold growth on the shells.
(D) Storing eggs in proximity to strong-smelling foods like onions can result in flavor absorption through the porous shell.

79. Match the processed egg products/processes in List I with their specific characteristics/purposes in List II.
List I: (Processed egg products/processes)
P. Desugarisation
Q. Liquid whole egg pasteurisation
R. Egg white (albumen) powder
S. Frozen salted egg yolk
List II: (Specific characteristics/purposes)
I. Highly susceptible to thermal coagulation, requiring careful temperature control (e.g., 60°C for 3.5 mins)
II. Often has salt or sugar added to prevent gelation upon thawing
III. Used extensively in the baking industry for its superior foaming properties
IV. Removal of glucose using enzymes (glucose oxidase) to prevent Maillard browning during drying
(A) P-IV, Q-I, R-III, S-II
(B) P-I, Q-II, R-IV, S-III
(C) P-IV, Q-III, R-I, S-II
(D) P-III, Q-I, R-II, S-IV

80. Which of the following is a correctly matched pair regarding egg sanitation?
(A) Egg washing – Immersion of eggs in cold water to close shell pores.
(B) Candling – Manual application of chemical sanitiser to the shell.
(C) Oil coating – Spraying eggs with mineral oil to seal pores.
(D) Thermostabilisation – Freezing the egg to kill surface Salmonella.

81. Read the given statements and select the correct option:
Statement I: Liquid egg white requires milder pasteurisation temperatures than liquid whole egg or egg yolk.
Statement II: The proteins in egg white, such as conalbumin, denature and coagulate at lower temperatures than those found in the yolk.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

82. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): The process of desugarisation is a critical step prior to the spray drying of egg whites.
Reason (R): Naturally occurring glucose in the albumen reacts with amino groups during the drying process, causing severe browning and insolubility.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

83. A consumer reports finding a greenish-black ring around the yolk of a hard-boiled egg. As a food scientist, you know this is a non-toxic chemical reaction. What components react to cause this discoloration?
(A) Iron from the yolk reacting with hydrogen sulfide from the albumen during heating.
(B) Calcium from the shell reacting with lipids in the yolk during boiling.
(C) Oxidation of xanthophyll pigments due to oxygen permeating the egg shell.
(D) Bacterial degradation of ovalbumin proteins within the thick egg white.

84. All of the following criteria are used in the standard grading of shell eggs, except:
(A) Condition and cleanliness of the shell
(B) Size of the air cell
(C) Exact cholesterol content of the yolk
(D) Clarity and firmness of the albumen

Downloaded from www.pdf.tube

1. Evisceration
2. Stunning and shackling
3. Hide removal (Dehiding)
4. Exsanguination (Bleeding)
5. Carcass splitting and washing

(A) 2, 4, 3, 1, 5
(B) 2, 3, 4, 1, 5
(C) 4, 2, 3, 1, 5
(D) 2, 4, 1, 3, 5

101. What does the term "dressing percentage" specifically refer to in the meat industry?
(A) Ratio of hot carcass weight to live animal weight, as a percentage.
(B) The total percentage of lean muscle meat obtained after carcass deboning.
(C) The total percentage of blood lost during the exsanguination process.
(D) The maximum percentage of added water permitted in processed meats.

102. Identify the correct statement regarding "cold shortening" in meat processing.
(A) It occurs when a pre-rigor carcass is chilled too slowly, causing excessive ultimate tenderness.
(B) It is a highly desirable phenomenon that increases the water-holding capacity of fresh pork.
(C) It only occurs in meat that has been fully aged for 14 days.
(D) Severe muscle toughening when a pre-rigor carcass is chilled below 10 °C while ATP remains.

103. Which of the following is the most appropriate primary objective for chilling meat carcasses rapidly post-mortem?
(A) To maximize proteolytic enzyme activity for rapid tenderisation.
(B) To retard growth of pathogens and spoilage organisms.
(C) To intentionally induce cold shortening for firmer meat texture.
(D) To completely prevent rigor mortis from occurring in the meat.

104. If a meat processing facility wishes to maximize the natural tenderisation of beef via ageing, they rely on the activity of calpains. These endogenous proteases are heavily dependent on which specific ion for their activation within the post-mortem muscle?
(A) Sodium (Na^+)
(B) Potassium (K^+)
(C) Calcium (Ca^{2+})
(D) Magnesium (Mg^{2+})

NODIA

105. As a Food Safety Officer conducting a post-mortem inspection of a pork carcass, you are tasked with examining the mandibular and mesenteric lymph nodes. What are you primarily checking for in these specific locations?
(A) Visual signs of Trichinella spiralis larval encystment in muscles.
(B) The visual degree of marbling and backfat color of the carcass.
(C) The actual mechanical progression of rigor mortis in the limbs.
(D) Evidence of localized or systemic infections like tuberculosis.

106. Under standard food safety regulations (e.g., FSSAI), what is the maximum permitted residual limit of sodium nitrite in cured meat products?
(A) 50 ppm
(B) 200 ppm
(C) 500 ppm
(D) 1000 ppm

107. Consider the following ingredients commonly used in meat curing:
I. Sodium chloride (Salt)
II. Sodium nitrite
III. Sodium ascorbate / Erythorbate
IV. Sucrose (Sugar)
Which of the statements below best describes their collective functions?
(A) I adds flavor and preserves; II provides color and prevents botulism; III accelerates color formation; IV tempers harshness of salt.
(B) I provides color; II prevents oxidation; III prevents botulism; IV accelerates curing.
(C) I acts as a binder; II sweetens; III preserves; IV provides color.
(D) I accelerates color; II adds flavor; III tempers salt; IV prevents botulism.

108. Which of the following statements regarding a "meat emulsion" (like frankfurters) is incorrect?
(A) A meat emulsion is technically a complex matrix where fat particles are stabilized by a network of solubilized muscle proteins.
(B) Adding ice/water during chopping is primarily done to dilute the salt concentration.
(C) Myosin is the most crucial protein for

ANSWERS

1. (B) 1.028 to 1.032
Normal whole cow milk typically has a specific gravity ranging from 1.028 to 1.032 at 15.5 °C. This fundamental physical property is heavily influenced by the concentration of solids-not-fat, such as proteins, lactose, and minerals, which increase the density, as well as the fat content, which conversely acts to decrease it.

2. (A) I and III only
Fresh cow milk exhibits a slightly acidic pH ranging from 6.5 to 6.7 due to natural buffering systems. Its boiling point is slightly higher than 100 °C because dissolved solutes, primarily lactose and minerals, elevate the boiling point. Conversely, dissolved solutes depress the freezing point, while fresh milk acidity is due to phosphates, proteins, and citrates.

3. (A) Skim milk is often added to whole milk to increase the overall fat percentage.
Milk standardisation involves adjusting the ratio of fat to solid-not-fat to meet legal requirements. Skim milk contains virtually no fat, so adding it to whole milk decreases the overall fat percentage while increasing the solid-not-fat proportion. Pearson's square is a standard mathematical tool used to calculate these precise mixing ratios during industrial processing.

4. (A) P-II, Q-III, R-IV, S-I
Alkaline phosphatase serves as an indicator enzyme because its thermal inactivation temperature closely mirrors that of heat-resistant pathogens. Lipase causes hydrolytic rancidity by breaking down milk lipids. Casein is the primary milk protein that precipitates at an acidic pH of 4.6, whereas whey proteins are heat-sensitive and remain dissolved without coagulating under standard rennet action.

5. (A) High Temperature Short Time (HTST) – 72 °C for 15 seconds
High Temperature Short Time pasteurisation requires heating milk to at least 72 °C and holding it for 15 seconds to eliminate vegetative pathogens. Low Temperature Long Time pasteurisation requires 63 °C for 30 minutes. These legal minimum thermal treatments ensure microbiological safety while preserving the nutritional quality and sensory characteristics of fluid milk.

6. (A) Both Statement I and Statement II are correct.
Homogenisation reduces fat globule size, increasing their surface area and preventing the formation of a cream layer. However, this disruption exposes the triacylglycerols to endogenous lipases. Therefore, unless the milk is pasteurised to inactivate these lipase enzymes prior to or immediately after homogenisation, rapid lipolysis occurs, leading to highly undesirable hydrolytic rancidity.

7. (A) Both A and R are true and R is the correct explanation of A.
Testing for active alkaline phosphatase is a standard quality control method used to verify pasteurisation efficiency. Since this indigenous milk enzyme is slightly more heat-resistant than Coxiella burnetii, the most heat-tolerant non-spore-forming pathogen in milk, its complete thermal destruction reliably indicates that the thermal process was sufficient to eliminate all target pathogens.

8. (C) Post-pasteurisation contamination from the cooling plates.
Psychrotrophic bacteria are generally heat-sensitive and do not survive pasteurisation temperatures. Their presence in freshly pasteurised milk indicates post-pasteurisation contamination, which often occurs on the cooling plates of heat exchangers or during downstream packaging operations. These cold-tolerant microorganisms multiply under refrigeration, producing proteolytic and lipolytic enzymes that cause rapid spoilage.

9. (D) Complete destruction of all bacterial endospores.
Pasteurisation is a mild heat treatment designed to destroy all vegetative pathogenic microorganisms, reduce spoilage microbiota, and inactivate enzymes like lipase to extend shelf life. However, pasteurisation temperatures are insufficient to destroy bacterial endospores, such as those from Bacillus or Clostridium species, which require

Click Here to Buy book on Amazon

completely serialize the meat product.
(B) Hanging carcasses in a temperature and humidity-controlled room for weeks.
(C) Adding salt, nitrites, and sugar to preserve, improve color, and flavor.
(D) The mechanical injection of water into meat to increase its final sale weight.

117. Identify the correct statement regarding the use of "liquid smoke" in modern meat processing.
(A) It is produced by hardwood pyrolysis, filtering out harmful polycyclic hydrocarbons.
(B) It is banned under most international food safety regulations due to high tar content.
(C) It provides typical smoky color but completely lacks any useful antimicrobial action.
(D) It must be applied via high-pressure mechanical injection into the carcass center.

118. Which of the following ingredients is most appropriately used as a "binder" or "extender" in processed meat formulations to improve water-holding capacity and reduce costs?
(A) Sodium nitrite
(B) Ascorbic acid
(C) Lactic acid starter culture
(D) Textured soy protein

119. A food scientist is formulating a frankfurter emulsion. They know that maximum protein extraction (solubilization of myosin) is essential for emulsion stability. Which condition is most critical to achieve this extraction during chopping?
(A) Adding specific acidic phosphates to lower the pH of the mixture.
(B) Chopping with 2-3% salt while keeping temperatures below 5-10 °C.
(C) Chopping the meat at freezing temperatures without adding any salt.
(D) Heating the entire meat mixture to 60 °C before adding the fat.

120. As a Food Safety Officer, you take samples of commercially produced bacon to test for nitrite levels. High heat cooking (like frying bacon) in the presence of excessively high residual nitrites poses a risk of forming which known carcinogens?
(A) Aflatoxins
(B) Heterocyclic amines ONLY
(C) Nitrosamines
(D) Polychlorinated biphenyls (PCBs)

121. What specific chemical compound, unique to marine fish, serves as an osmoregulator and is later reduced by spoilage bacteria to produce the characteristic "fishy" odor?
(A) Geosmin
(B) Histidine
(C) Putrescine
(D) Trimethylamine oxide (TMAO)

122. Consider the following chemical and physical indicators often used to assess fish spoilage:
I. Increase in Total Volatile Base Nitrogen (TVB-N)
II. Elevated levels of Trimethylamine (TMA)
III. High K-value based on nucleotide degradation
IV. Firm, elastic flesh and bright, clear eyes
Which of these clearly indicate progressive spoilage in post-harvest fish?
(A) I and II only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

123. Which of the following statements regarding rigor mortis in fish is incorrect?
(A) Rigor mortis in fish generally occurs faster and lasts for a shorter duration compared to terrestrial mammals.
(B) Filleting fish in full rigor prevents muscle gaping and yields high quality.
(C) Rough manual handling of fish during the catch process accelerates rigor onset.
(D) The breakdown of ATP initiates the rigor process in fish, just as it does in mammals.

124. Match the fish processing/preservation methods in List I with their underlying mechanisms in List II.
List I: (Fish processing/preservation methods)
P. Icing
Q. Glazing (frozen fish)
R. Heavy salting
S. Canning
List II: (Underlying mechanisms)
I. Lowers the water activity (a_w) to inhibit microbial growth and enzymatic activity
II. Destroys vegetative pathogens and spores through intense thermal treatment
III. Applies a thin layer of ice over the frozen fish surface to prevent dehydration (freezer burn) and oxidation
IV. Lowers temperature close to 0 °C to slow

NODIA

monitoring sheets for 2 years
(A) P-III, Q-II, R-I, S-IV
(B) P-II, Q-III, R-IV, S-I
(C) P-III, Q-I, R-II, S-IV
(D) P-I, Q-IV, R-II, S-III

140. Which of the following is the correctly matched pair regarding standard storage temperatures for animal-based foods?
(A) Frozen fish – Store at -5 °C
(B) Chilled fresh meat – Store between 0 °C to 4 °C
(C) UHT Milk (Unopened) – Strict refrigeration required (below 4 °C)
(D) Shell eggs – Store at 25 °C for maximum shelf life

141. Read the given statements and select the correct option:
Statement I: According to FSSAI packaging and labelling regulations, milk and milk products (like paneer and ghee) are considered vegetarian and must bear the green dot logo.
Statement II: Eggs and products containing egg must bear the brown dot logo, denoting them as non-vegetarian.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

142. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Traceability systems are a mandatory requirement in the meat and seafood processing industry.
Reason (R): In the event of a food safety hazard (e.g., Salmonella outbreak), traceability allows for the rapid identification, isolation, and recall of the specific affected product batches from the supply chain.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

143. A shipment of frozen prawn reaches a retail distribution center. The temperature data logger reveals that for 12 hours during transit, the container temperature rose to +5 °C before being brought back down to -18 °C. Upon inspection, the boxes are covered in thick frost and the prawn exhibit excessive drip loss upon thawing. What failure has occurred?
(A) Severe histamine formation from temperature abuse, rendering the prawn highly toxic.
(B) Complete bacterial putrefaction by psychrotrophic bacteria inside the container.
(C) Direct cross-contamination with pathogenic Listeria monocytogenes during transit.
(D) Temperature abuse causing partial thawing, refreezing, and ice crystal damage.

144. All of the following are typically mandatory labelling requirements on a retail package of processed cheese, except:
(A) Declared net weight of the product.
(B) Official FSSAI license registration number.
(C) The exact farm milking location.
(D) Comprehensive nutritional information panel.

145. What is the primary cause-and-effect relationship regarding fluctuating temperatures in a frozen food cold store (e.g., fluctuating between -18 °C and -10 °C)?
(A) It causes complete destruction of all remaining active bacterial spores in the food.
(B) Moisture migration and ice recrystallisation, causing freezer burn and texture loss.
(C) It enhances the activity of lipases, drastically improving the flavor of frozen meat.
(D) It causes the primary plastic packaging material to instantly shatter due to stress.

146. Which of the following best defines a "Cold Chain" in food distribution?
(A) The physical process of rapidly freezing food items using liquid nitrogen or carbon dioxide.
(B) Slaughterhouse equipment used to bring the carcass temperature down to 4 °C within 2 hours.
(C) The winter season supply logistics and transportation systems for perishable food goods.
(D) An uninterrupted series of refrigerated activities and logistics maintaining low temperature.

Downloaded from www.pdf.tube

monophosphate (IMP) imparts a bitter, spoiled flavor to fresh fish.
(C) Calpains and cathepsins contribute to softening of fish muscle.
(D) Autolysis completely halts once the fresh fish is placed on ice at 0 °C.

133. Which of the following is the most appropriate process to remove pathogenic bacteria and viruses from live bivalve molluscs (like oysters and clams) prior to human consumption?
(A) Depuration in tanks of clean, circulating, sterilized seawater.
(B) Subjecting the live shells to high doses of gamma irradiation.
(C) Freezing the live molluscs at -20 °C for at least 7 days.
(D) Soaking the live molluscs in concentrated acetic acid solutions.

134. In evaluating fish freshness, the K-value is widely used. The calculation of the K-value relies on tracking the degradation pathway of which specific nucleotide?
(A) Guanosine Triphosphate (GTP)
(B) Uridine Triphosphate (UTP)
(C) Cytidine Triphosphate (CTP)
(D) Adenosine Triphosphate (ATP)

135. As a Food Safety Officer auditing a shrimp processing line, you observe workers dipping peeled shrimp into a solution of Sodium Tripolyphosphate (STPP). What is the primary technological justification for this practice, and what must you monitor?
(A) STPP is used to chemically bleach the shrimp white; you must monitor for toxic chemical residues.
(B) STPP increases moisture retention and texture; you must monitor weight and label added phosphates.
(C) STPP is primarily used to prevent melanosis; you must monitor active residual sulfur dioxide levels.
(D) STPP acts as a strong sanitiser; you must monitor the active chlorine equivalent concentration.

136. In a standard HACCP plan for a fluid milk processing plant, which of the following steps is universally identified as a Critical Control Point (CCP)?
(A) Receiving raw milk
(B) Clarification and separation
(C) HTST Pasteurisation
(D) Homogenisation

137. Consider the following components vital to maintaining an unbroken cold chain for processed meat products:
I. Refrigerated transport vehicles equipped with temperature data loggers.
II. Pre-cooling of the product to the target transport temperature before loading.
III. Utilizing thermal blanketing during loading dock transfers.
IV. Turning off transport refrigeration units during transit to save fuel if ambient temperatures are mild.
Which of these represent proper cold chain management practices?
(A) I and II only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

138. Which of the following statements regarding the labelling requirements for processed animal products in India (FSSAI) is incorrect?
(A) Allergen declarations are strictly optional for dairy and egg products.
(B) Non-vegetarian food must carry a prominent brown circle within a brown square on the label.
(C) The list of ingredients must be declared in descending order of their weight or volume at the time of their use in the manufacture.
(D) Date of manufacture and "Use by" or "Expiry" date must be clearly stated.

NODIA

139. Match the HACCP Principles in List I with their corresponding actions in a meat processing plant in List II.
List I: (HACCP Principles)
P. Principle 1: Conduct a hazard analysis
Q. Principle 3: Establish critical limits
R. Principle 4: Establish monitoring procedures
S. Principle 7: Establish record-keeping
List II: (Actions)
I. Logging the internal temperature of every batch of cooked sausages
II. Determining that the cooking step must reach an internal temperature of 71.1 °C
III. Identifying Listeria monocytogenes as a potential biological risk in sliced ham
IV. Maintaining calibration logs and CCP

heating or cooling. The holding tube ensures the milk remains at the sterilisation temperature for the exact required residence time.

20. (C) Thermisation – Mild heating to temporarily extend raw milk storage
Thermisation is a mild thermal process, typically involving temperatures of 57 °C to 68 °C for 15 seconds, designed to temporarily restrict psychrotrophic bacterial growth in raw milk prior to further processing. Direct UHT processing utilizes steam injection or infusion, while indirect UHT utilizes plate or tubular heat exchangers. In-container sterilisation requires longer heating times.

21. (A) Both Statement I and Statement II are correct.
Direct UHT processing methods, such as steam injection or infusion, heat milk extremely rapidly, reducing total thermal stress and minimizing chemical changes like browning. Indirect methods, which use plate or tubular heat exchangers, rely on heat transfer through a physical barrier. This results in slower heating rates and higher cumulative thermal damage to heat-sensitive milk components.

22. (A) Both A and R are true and R is the correct explanation of A.
Direct UHT heating introduces steam directly into milk, which dilutes the product with water. To maintain the original composition, flash cooling in a vacuum chamber is executed immediately after the holding tube. The vacuum pressure is calibrated so that the flash evaporation process removes precisely the same amount of water that was condensed during the steam heating phase.

23. (B) Survival of heat-resistant proteases from psychrotrophic bacteria.
Psychrotrophic bacteria, such as Pseudomonas species, synthesize extracellular proteases during raw milk storage. Although the bacteria themselves are destroyed by UHT treatment, their enzymes are highly heat-resistant and can survive the process. Over extended ambient storage, these active proteases hydrolyze caseins, leading to the development of bitter peptides and eventual age gelation of the product.

24. (C) Soaking in a 5% sodium chloride solution
Aseptic packaging requires effective sterilisation of the packaging material before filling. Industry-standard methods include hydrogen peroxide baths followed by hot air drying, ultraviolet irradiation, and gaseous chlorine dioxide treatments. Soaking in a five percent sodium chloride solution has no significant sporicidal or sterilising efficacy and is never used as a sterilisation method in aseptic packaging systems.

25. (D) Denaturation of whey proteins releasing volatile sulfhydryl compounds.
The characteristic cooked flavor in UHT-treated milk is primarily caused by the thermal denaturation of whey proteins, especially beta-lactoglobulin. This denaturation process exposes and breaks down disulfide bonds, releasing volatile sulfhydryl compounds such as hydrogen sulfide. These active sulfur-containing compounds are highly volatile and impart the distinct cooked or sulfury aroma to the processed milk.

26. (A) The absence of microorganisms capable of growing under normal non-refrigerated storage.
Commercial sterility is defined as the condition achieved by application of heat which renders the food free of microorganisms capable of reproducing in the food under normal non-refrigerated conditions of storage and distribution. This differs from absolute sterility, as harmless, highly thermophilic spores may survive but cannot germinate or grow under standard ambient conditions.

27. (B) Ethylene Vinyl Alcohol (EVOH) can be used as an oxygen barrier layer in co-extruded plastic aseptic bottles.
Co-extruded plastic aseptic bottles frequently incorporate Ethylene Vinyl Alcohol as a barrier layer because of its exceptional gas barrier properties, which prevent oxygen ingress and protect the milk from oxidative degradation. Conversely, paperboard provides structural rigidity but lacks gas barrier properties, while the innermost layer of cartons is polyethylene, which serves as a liquid-tight sealant.

28. (B) To act as a buffer and maintain continuous steriliser operation during packaging stops.
An aseptic surge tank is positioned between the UHT steriliser and the packaging system to act as a sterile buffer. This tank collects sterile product, allowing the continuous UHT heating system to operate uninterrupted even if the packaging line experiences temporary stoppages. This prevents

Click Here to Buy book on Amazon

147. Identify the correct statement regarding allergen labelling for animal-based foods.
(A) Fish and shellfish are major allergens that must be explicitly declared on labels.
(B) Milk is not considered a major food allergen under any international labelling regulations.
(C) Egg presence only needs declaration if it exceeds a 5% threshold of the total weight.
(D) Refining of fish oil completely removes all allergen labelling requirements under the law.

148. Which of the following procedures is the most appropriate method for "Validating" a Critical Control Point (CCP) for cooking in a newly developed HACCP plan for roast beef?
(A) Checking and logging the internal oven temperature gauge on a daily basis.
(B) Reviewing the completed CCP monitoring logs at the end of every operating week.
(C) Conducting challenge studies to prove the cook step achieves required Salmonella log reduction.
(D) Calibrating the digital meat thermometer against an ice bath once every month.

149. A food manufacturer is determining the "Use By" date for a new pasteurised crab meat product. Which of the following factors is the most critical to consider when establishing this date to ensure consumer safety?
(A) When Listeria monocytogenes could multiply to dangerous levels under refrigeration.
(B) The point at which the packaged crab meat product loses its original bright pink color.
(C) The chemical rate of degradation of the primary plastic packaging material during storage.
(D) The overall cost and financial viability of the current product formulation ingredients.

150. As a Food Safety Officer auditing a meat processing facility, you find that the monitoring records for the metal detector (a designated CCP) are consistently filled out in advance for the entire shift. What does this indicate?
(A) Highly efficient and excellent proactive management practices by the line operator.
(B) A minor operational deviation that can be ignored if the metal detector is working.
(C) Successful validation of the overall metal detector sensitivity and efficiency levels.
(D) A failure of HACCP monitoring and a critical violation indicating record falsification.

www.nodia.in

Downloaded from www.pdf.tube

maintaining the stability of a meat emulsion.
(D) Chopping the mixture at too high a temperature can cause emulsion breakdown or "fatting out" during cooking.

109. Match the types of processed meats in List I with their standard examples in List II.
List I: (Types of processed meats)
P. Fresh sausages
Q. Cooked smoked sausages
R. Dry/Semi-dry fermented sausages
S. Whole muscle cured meats
List II: (Standard examples)
I. Salami, Pepperoni
II. Frankfurters, Bologna
III. Breakfast pork links, Bratwurst (uncooked)
IV. Prosciutto, Bacon
(A) P-III, Q-II, R-I, S-IV
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-IV, R-I, S-II
(D) P-II, Q-III, R-IV, S-I

110. Which of the following is the correctly matched pair regarding the quality attributes of meat?
(A) Water Holding Capacity (WHC) – The ability of meat to absorb marinade rapidly
(B) Myoglobin – The primary connective tissue protein causing toughness
(C) Marbling – Intramuscular fat that contributes to juiciness and flavor
(D) Collagen – The pigment responsible for the red color of meat

111. Read the given statements and select the correct option:
Statement I: Smoking of meat products imparts desirable organoleptic properties, including specific flavors and a mahogany color.
Statement II: Smoke components, such as phenols and organic acids, exhibit mild antimicrobial and antioxidant properties, enhancing the shelf life of the meat.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

112. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): The use of sodium ascorbate or erythorbate is critical in modern nitrite meat curing processes.
Reason (R): These reducing agents accelerate the conversion of nitrite to nitric oxide and significantly inhibit the formation of carcinogenic nitrosamines.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

113. A batch of vacuum-packaged cooked ham exhibits severe color fading, turning grayish-brown under retail display lighting. Microbiological tests are normal. What is the most likely cause of this quality defect?
(A) Excessive initial addition of sodium nitrite to the curing brine.
(B) Photo-oxidation of nitrosylhemochrome due to light and residual oxygen.
(C) Unchecked proliferation of spoilage-inducing lactic acid bacteria.
(D) Excessive overcooking of the ham during the final thermal processing stage.

114. All of the following are typically classified as dry or semi-dry fermented sausages, except:
(A) Chorizo
(B) Salami
(C) Summer sausage
(D) Mortadella

115. What is the cause-and-effect relationship regarding meat color when freshly cut beef is exposed to oxygen?
(A) Deoxymyoglobin binds with oxygen to form bright red oxymyoglobin.
(B) Red oxymyoglobin slowly oxidizes to form brown metmyoglobin pigment.
(C) Nitrosylhemochrome pigment forms, turning the cured meat pink.
(D) Intracellular cytochromes degrade, rendering the meat colorless.

116. What does the term "curing" technically define in the context of meat processing?
(A) The application of high temperatures to

NODIA

higher thermal processing like sterilisation to be completely eliminated.

10. (A) 2, 1, 3, 4, 5
Commercial fluid milk processing begins with clarification to remove physical impurities and somatic cells. Next, standardisation adjusts the fat and solid-not-fat ratios. The milk is then homogenised to prevent fat separation, followed by pasteurisation to ensure microbiological safety. Finally, the processed milk is chilled and packaged under hygienic conditions to preserve shelf life.

11. (B) Milk prepared by admixing whole milk with skim milk, containing minimum 3.0% fat and 8.5% SNF.
Under standard food safety regulations, toned milk is defined as a product prepared by blending whole milk with reconstituted skim milk or skim milk powder. This process standardises the composition to meet specific legal limits, which mandate a minimum of 3.0% milk fat and 8.5% solid-not-fat, ensuring a nutritious and consistent product for consumers.

12. (B) Lactose and whey proteins are present in true solution.
Milk is a complex multicomponent system containing substances in various physical states. Lactose, soluble minerals, and whey proteins exist in a true aqueous solution. In contrast, milk fat is suspended as an oil-in-water emulsion, while hydrophobic casein proteins exist as colloidal suspensions called micelles, which are stabilized by calcium phosphate linkages.

13. (A) Absence of a visible cream layer after 48 hours of storage.
Homogenisation is designed to reduce the size of fat globules, thereby preventing them from coalescing and rising to the surface. Under standard quality testing, a successfully homogenised milk sample will show no visible cream separation or significant fat percentage difference between the top and bottom layers of a container after forty-eight hours of quiescent storage.

14. (A) Minimum 1.5% fat and 9.0% SNF
Double toned milk is a standardised dairy product formulated to have a lower fat content and a higher solid-not-fat content compared to regular toned milk. Food safety regulations specify that double toned milk must be adjusted to contain a minimum of 1.5% milk fat and a minimum of 9.0% solid-not-fat to comply with legal definitions.

15. (D) Meeting the legal minimum pasteurisation temperature requirement.
The flow diversion valve in a pasteurisation system is a critical safety device designed to automatically divert milk back to the raw balance tank if the temperature falls below the required legal minimum. When this valve operates erratically, it allows under-pasteurised milk to pass forward, directly compromising the pasteurisation temperature requirement and creating a biological hazard.

16. (C) 135 °C to 150 °C for 1 to 8 seconds
Ultra-High Temperature processing requires heating milk to temperatures between 135 °C and 150 °C for a brief holding period of 1 to 8 seconds. This rapid, intense thermal treatment achieves commercial sterility by destroying all viable spoilage microorganisms and spores while minimizing chemical changes, such as nutrient loss and cooked flavor development.

17. (A) I, II, and III only
Aseptic packaging requires sterile conditions and chemical sterilisation of the packaging material, typically using hydrogen peroxide. The multi-layered carton uses aluminum foil to block light and oxygen, preventing lipid oxidation. However, these cartons are not made of a single polyethylene layer; they consist of multiple layers, including paperboard for structural strength and polyethylene for liquid sealing.

18. (D) UHT milk is completely sterile and free of any active spores or enzymes.
Ultra-High Temperature processing achieves commercial sterility, meaning it eliminates all microorganisms capable of growing under normal storage conditions. However, it does not mean absolute chemical sterility. Some highly heat-resistant bacterial endospores or extremely stable proteolytic and lipolytic enzymes can survive this heat treatment, potentially causing gelation or off-flavors during extended ambient storage.

19. (A) P-IV, Q-III, R-II, S-I
In direct UHT systems, the steam injector introduces culinary steam directly into the milk for rapid heating, while the flash vessel removes this added water under a vacuum. Tubular heat exchangers provide indirect heat transfer for

Click Here to Buy book on Amazon

down bacterial spoilage and autolytic enzyme activity
(A) P-IV, Q-III, R-I, S-II
(B) P-III, Q-IV, R-I, S-II
(C) P-IV, Q-I, R-III, S-II
(D) P-I, Q-II, R-IV, S-III

125. Which of the following is the correctly matched pair regarding quality issues in seafood?
(A) Melanosis – Black spots in shrimp from polyphenol oxidase.
(B) Scombroid poisoning – Heavy accumulation of mercury in marine bivalves.
(C) Paralytic Shellfish Poisoning – Bacterial spoilage of coastal crab meat.
(D) Gaping – Tearing of the outer shrimp exoskeleton during active molting.

126. Read the given statements and select the correct option:
Statement I: Scombroid fish poisoning is caused by the ingestion of toxic levels of histamine formed in the fish post-harvest.
Statement II: Histamine is produced by the enzymatic decarboxylation of the amino acid histidine by specific spoilage bacteria when the fish is subjected to temperature abuse.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

127. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Shrimp and prawns are frequently treated with sodium bisulfite dips immediately after harvesting.
Reason (R): Sodium bisulfite acts as a potent inhibitor of polyphenol oxidase, thereby preventing the enzymatic browning defect known as melanosis (black spot).
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

128. A batch of canned tuna is suspected of causing illness. The cans appear severely swollen. Upon opening, a foul, putrid odor is evident. Which specific microbial failure in the canning process is most likely responsible for this?
(A) Survival of non-proteolytic Clostridium botulinum due to insufficient thermal processing (F_0 value).
(B) Survival of thermophilic spore formers (like Geobacillus stearothermophilus) coupled with storage at high ambient temperatures.
(C) Post-processing contamination by mesophilic spoilage bacteria through micro-leaks in the can seams.
(D) Cross-contamination with Salmonella during labeling.

129. All of the following are standard methods utilized for the rapid chilling of freshly caught fish onboard vessels, except:
(A) Flake ice packing methods
(B) Brine immersion freezing at -40 °C
(C) Refrigerated Sea Water (RSW) tanks
(D) Chilled Sea Water (CSW) tank systems

130. Arrange the following steps of standard commercial fish canning in the correct sequential order:
1. Retorting (Thermal processing)
2. Beheading, gutting, and cleaning
3. Exhausting (Removal of air)
4. Seaming (Hermetic sealing)
5. Pre-cooking and filling
(A) 2, 5, 3, 4, 1
(B) 2, 3, 5, 4, 1
(C) 5, 2, 3, 4, 1
(D) 2, 5, 4, 3, 1

NODIA

131. What is the correct definition of "Surimi"?
(A) Washed and stabilised minced fish paste used to make structured seafood.
(B) A traditional Japanese fermented sauce prepared using whole small fish.
(C) Raw fish that has been heavily salted and dried in the sun for months.
(D) A specific, newly discovered species of deep-water marine shellfish.

132. Identify the correct statement regarding the post-mortem autolytic changes in fish.
(A) Autolytic changes are entirely driven by external bacterial contamination.
(B) The breakdown of ATP to inosine

thermal degradation of milk that would occur if the steriliser was shut down.

29. (A) The holding time decreases, failing to achieve commercial sterility.
In continuous UHT systems, safety depends on maintaining milk at the sterilisation temperature for a precise holding time. If the flow rate increases unexpectedly due to a faulty timing pump, milk passes through the holding tube too quickly. This decreased residence time prevents the complete destruction of bacterial endospores, failing to achieve commercial sterility and compromising product safety.

30. (C) Hydrogen peroxide bath concentration and temperature.
Chemical sterilisation of the packaging material web in aseptic packaging systems depends heavily on the concentration and temperature of the hydrogen peroxide bath. To ensure proper sanitisation and spore inactivation before the filling phase, these critical parameters must be continuously monitored and logged as part of the facility's hazard control and quality assurance protocols.

31. (D) Chymosin (Rennet)
Chymosin, the primary active enzyme in traditional rennet, initiates the enzymatic coagulation of milk during cheese making. It specifically cleaves the peptide bond between phenylalanine and methionine residues in kappa-casein. This cleavage releases the hydrophilic glycomacropeptide, destabilizing the casein micelle structure and allowing the remaining hydrophobic para-casein micelles to aggregate in the presence of calcium.

32. (A) I, II, III, IV
Traditional Cheddar cheese manufacturing begins with adding starter culture and rennet to coagulate the milk. The resulting gel is cut into small cubes to facilitate whey syneresis. The curd is then cooked and pitched to promote drainage. Finally, the drained curd is subjected to cheddaring, milling, salting, and pressing to form the final blocks.

33. (B) Hard cheeses like Parmesan require a shorter ripening period compared to soft cheeses like Brie.
Cheese ripening is a complex biochemical process where microbial and milk enzymes break down proteins, lipids, and carbohydrates to develop specific flavors and textures. Hard cheeses, such as Parmesan, have low moisture levels and require significantly longer ageing periods, often lasting several months or years, compared to high-moisture soft cheeses, which mature within a few weeks.

34. (A) P-II, Q-I, R-IV, S-III
Mozzarella is manufactured using the pasta filata technique, which involves stretching the curd in hot water. Roquefort is an internally mold-ripened cheese utilizing Penicillium roqueforti. Swiss cheese develops characteristic eyes through carbon dioxide produced by Propionibacterium freudenreichii. Camembert is surface-ripened using white molds, specifically Penicillium camemberti, which create a soft, velvety rind.

35. (A) Yoghurt – Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus
Traditional yoghurt manufacture requires a specific symbiotic starter culture combination containing Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus. These two thermophilic bacteria work together to rapidly ferment lactose into lactic acid, which drops the pH, coagulates casein, and produces key volatile flavor compounds, such as acetaldehyde, responsible for the characteristic aroma of fresh yoghurt.

36. (A) Both Statement I and Statement II are correct.
Yoghurt fermentation depends on a highly symbiotic relationship between two lactic acid bacteria. Streptococcus thermophilus grows first, producing formic acid and carbon dioxide, which stimulate the growth of Lactobacillus bulgaricus. In return, Lactobacillus bulgaricus exhibits proteolytic activity, liberating essential amino acids and peptides that stimulate the growth and acid production of Streptococcus thermophilus.

37. (A) Both A and R are true and R is the correct explanation of A.
Syneresis is a major quality defect in set yoghurt, characterized by the undesirable expulsion of whey from the protein gel network. This defect is caused by structural weaknesses in the acid-induced casein matrix. High incubation temperatures or mechanical agitation disrupt the gel, reducing its water-holding capacity and allowing free whey to pool on the product's surface.

Downloaded from www.pdf.tube

non-fat milk solids, such as proteins and lactose, to denature and precipitate. These solids are then physically separated by filtration or centrifugation, leaving behind pure milk fat.

58. (A) Baudouin test
The Baudouin test is a standard chemical assay used to detect the adulteration of ghee with hydrogenated vegetable fat, commonly known as Vanaspati. By regulation, Vanaspati must contain a small percentage of sesame oil, which contains sesamolin. This compound reacts with furfural in the presence of hydrochloric acid to produce a distinctive, easily detectable crimson-red color.

59. (C) 80%
Overrun percentage is calculated using the formula: volume of finished ice cream minus the volume of the original mix, divided by the volume of the mix, multiplied by one hundred. In this scenario, subtracting one hundred liters from one hundred and eighty liters yields eighty liters. Dividing eighty by one hundred and multiplying by one hundred results in an eighty percent overrun.

60. (B) Proliferation of pathogens in the nutrient-rich mix.
Ageing an ice cream mix at twelve degrees Celsius instead of the recommended four degrees Celsius compromises food safety. The pasteurised mix is highly nutritious and has a high water activity, making it an ideal medium for microbial growth. Elevated holding temperatures allow any surviving pathogens or post-pasteurisation contaminants to rapidly proliferate, presenting a significant biological safety hazard.

61. (B) 3.0% to 4.0%
Standard skimmed milk powder requires a low moisture content, typically between 3.0% and 4.0%, to ensure physical stability and prevent chemical degradation during storage. This dry state maintains low water activity, which effectively prevents the growth of microorganisms and slows down chemical reactions, such as the Maillard browning reaction, thereby preserving the quality and extending shelf life.

62. (D) I, II, III, and IV
Commercial production of spray-dried milk powder begins with pre-heating and pasteurising raw milk. The milk is then concentrated under a vacuum to forty to fifty percent total solids to make drying more energy-efficient. This concentrate is atomised into a chamber where hot air rapidly evaporates moisture. Finally, cyclones separate the dry powder from the exhaust air.

63. (D) Sweetened condensed milk undergoes a rigorous retort sterilisation at 121 °C for 15 minutes to ensure safety.
Sweetened condensed milk is preserved by osmotic pressure. The addition of high concentrations of sucrose lowers the water activity, which prevents microbial growth. Because of this high osmotic pressure, the product is commercially stable and does not require thermal retort sterilisation. Applying such intense heat would cause severe Maillard browning, caramelisation, and protein coagulation in the can.

64. (A) P-III, Q-IV, R-II, S-I
The chalazae are twisted, cord-like protein structures that anchor the yolk in the center of the egg albumen. The vitelline membrane is the clear sheath that holds the yolk. The cuticle is a natural waxy coating on the shell that seals pores. The air cell, located at the broad end, increases in size as moisture evaporates over time.

65. (B) Maillard browning – High temperature and moisture during storage
Maillard browning in milk powder is a chemical reaction between reducing sugars, primarily lactose, and the amino groups of proteins, such as lysine. This reaction is highly accelerated when milk powder is stored under conditions of elevated moisture content and high temperatures. It results in undesirable dark discoloration, off-flavors, and a significant loss of protein solubility.

66. (A) Both Statement I and Statement II are correct.
Whole milk powder contains a substantial amount of lipids, whereas skimmed milk powder contains virtually none. This high fat content makes whole milk powder highly susceptible to lipid oxidation when exposed to oxygen and light during storage. The resulting production of free radicals and volatile aldehydes causes oxidative rancidity, significantly shortening its shelf life compared to skimmed milk powder.

67. (A) Both A and R are true and R is the correct explanation of A.
Roller drying subjects milk concentrate to direct contact with steam-heated rotating drums,

NODIA

water into tiny droplets, which restricts bacterial growth.

48. (C) Ghee is an oil-in-water emulsion with a high moisture content of around 16%.
Ghee is virtually pure anhydrous milk fat, meaning it is not an oil-in-water emulsion, and its moisture content is legally restricted to less than 0.5% to ensure stability. It is produced by boiling butter or cream to evaporate water and precipitate non-fat solids, which are filtered out, leaving a shelf-stable lipid product with characteristic caramelized flavors.

49. (A) P-IV, Q-III, R-II, S-I
Milk solids-not-fat enhance ice cream texture and provide proteins that support the air cell structure. Stabilisers increase viscosity and prevent large ice crystal growth. Emulsifiers improve whipping and promote controlled fat destabilisation, which is essential for structure. Sweeteners provide necessary bulk and depress the freezing point, ensuring the ice cream remains scoopable at serving temperatures.

50. (D) Mottling – Uneven distribution of salt and moisture.
Mottling is a visual defect in butter characterized by the appearance of dark and light patches. This issue is caused by the uneven distribution of salt and moisture, which leads to localized variations in light reflection. Proper and thorough working of the butter after salting is essential to uniformly distribute moisture droplets and salt, thereby preventing mottling.

51. (C) Statement I is correct but Statement II is incorrect.
The freezing of ice cream mix involves a dynamic phase in a scraped-surface freezer, where rapid freezing and air incorporation occur, followed by a static hardening phase in a cold room. Overrun, which refers to the air incorporated into the mix, is achieved entirely during the dynamic scraping phase, not during the static hardening step.

52. (A) Both A and R are true and R is the correct explanation of A.
Hardening packaged ice cream rapidly at extremely low temperatures is critical for final quality. Fast cooling promotes the rapid nucleation of remaining water molecules, forming numerous tiny ice crystals rather than a few large ones. Slow freezing allows water to migrate and grow large, coarse ice crystals, which leads to an undesirable, gritty, or sandy mouthfeel.

53. (A) Excess milk solids-not-fat causing lactose crystallisation.
A sandy texture in ice cream is caused by the formation of large, insoluble crystals of alpha-lactose monohydrate during storage. This defect typically occurs when the formulation contains excess milk solids-not-fat, which increases the lactose concentration beyond its solubility limit. Fluctuating storage temperatures accelerate this crystallisation process, causing a gritty sensation on the consumer's palate.

54. (D) Haugh unit score
Standard quality parameters used to evaluate the purity and detect adulteration of ghee include the Reichert-Meissl value, Polenske value, and Butyro-Refractometer reading. These analytical tests measure specific physical and chemical properties of milk fat. In contrast, the Haugh unit score is an index used exclusively to assess the internal albumen quality of fresh shell eggs.

55. (B) The mix is held at 4 °C to crystallise fat and hydrate stabilisers, improving whipping and texture.
The ageing of ice cream mix involves holding the pasteurised and homogenised mixture at 4 °C for several hours. This cold holding step allows the emulsified milk fat to crystallise and gives the stabilising hydrocolloids sufficient time to fully hydrate. This physical change significantly improves the whipping capacity of the mix and enhances the final texture.

56. (C) The percentage volume increase of ice cream over the mix volume due to air incorporation.
Overrun is a critical quality parameter in ice cream manufacturing, defined as the percentage volume increase of the finished ice cream relative to the volume of the original liquid mix. This expansion is achieved by incorporating air during the dynamic freezing process in the scraped-surface freezer, which contributes to the product's characteristic light, creamy, and smooth texture.

57. (D) Evaporating water and precipitating non-fat solids by heating, then removing them.
The clarification of butter or cream to produce ghee is achieved by heating the raw material at elevated temperatures. This thermal process evaporates the moisture content and causes the

Click Here to Buy book on Amazon

115. (A) Deoxymyoglobin binds with oxygen to form bright red oxymyoglobin.
Freshly cut meat contains deoxymyoglobin, which has a dark purplish-red color. When exposed to atmospheric oxygen, this pigment binds with oxygen molecules to form oxymyoglobin, turning the meat a bright cherry-red color. This process, known as blooming, is reversible. Over time, further oxidation of the iron atom converts oxymyoglobin into brown metmyoglobin, indicating freshness loss.

116. (C) Adding salt, nitrites, and sugar to preserve, improve color, and flavor.
Curing is a traditional preservation and processing technology in the meat industry. It involves incorporating a mixture of sodium chloride, nitrites or nitrates, and sugars into the meat. This process lowers water activity to inhibit spoilage, develops the characteristic pink cured color, creates unique flavors, and provides crucial protection against the growth of pathogenic spore-forming bacteria.

117. (A) It is produced by hardwood pyrolysis, filtering out harmful polycyclic hydrocarbons.
Liquid smoke is manufactured by burning hardwood under controlled pyrolytic conditions, capturing the smoke in water, and filtering the solution. This filtration process removes insoluble tars and carcinogenic polycyclic aromatic hydrocarbons, such as benzo(a)pyrene. The resulting product provides consistent smoky flavor, color, and mild antimicrobial properties, representing a safer alternative to traditional direct smoking methods.

118. (D) Textured soy protein
Textured soy protein is a plant-derived ingredient commonly used as a binder or extender in processed meat formulations. It exhibits excellent water-binding and fat-emulsifying properties, which improve the cooking yield, moisture retention, and structural stability of the product. Additionally, incorporating these proteins reduces overall formulation costs while maintaining a high protein content.

119. (B) Chopping with 2-3% salt while keeping temperatures below 5-10 °C.
Solubilising myofibrillar proteins, primarily myosin, is critical to form a stable meat emulsion. This extraction requires a high ionic strength, which is achieved by chopping the meat with two to three percent salt. Additionally, the temperature must be kept below ten degrees Celsius to prevent thermal denaturation of these functional proteins, ensuring they can stabilize fat droplets.

120. (C) Nitrosamines
Cooking cured meats at high temperatures, such as frying bacon, can cause residual nitrites to react with secondary amines derived from amino acids. This chemical reaction leads to the formation of volatile nitrosamines, which are classified as potent carcinogens. To minimize this risk, food safety regulations strictly limit residual nitrite levels and encourage adding antioxidants.

121. (D) Trimethylamine oxide (TMAO)
Trimethylamine oxide is an organic compound that serves as an osmoregulator in the muscle tissue of marine fish. After harvest, spoilage bacteria utilize TMAO as an electron acceptor during anaerobic respiration, reducing it to volatile trimethylamine. This basic nitrogen compound is responsible for the characteristic pungent, fishy odor associated with stale or spoiling seafood.

122. (B) I, II, and III only
Post-harvest fish spoilage is measured using chemical and physical indicators. Progressive bacterial decomposition increases total volatile base nitrogen and trimethylamine levels, which correspond to protein and amine degradation. Additionally, enzymic breakdown of nucleotide phosphates increases the K-value. Firm, elastic flesh and clear eyes are characteristics of fresh fish, not spoiled fish.

123. (B) Filleting fish in full rigor prevents muscle gaping and yields high quality.
Filleting fish when they are in full rigor mortis is highly undesirable. During rigor, the muscles are severely contracted. Processing or bending the rigid carcass at this stage tears the connective tissue between muscle layers, causing a defect known as gaping. To ensure optimal fillet quality, fish should be filleted either pre-rigor or post-rigor.

124. (A) P-IV, Q-III, R-I, S-II
Packing fish in ice keeps the temperature near 0 °C, slowing down bacterial and enzymatic activities. Glazing applies a thin ice layer over frozen fish to prevent sublimation and oxidation. Heavy salting lowers water activity to inhibit micro-organisms. Thermal canning destroys vegetative pathogens

NODIA

exposing it to high temperatures. This intense heat causes severe thermal denaturation of milk proteins, particularly caseins and whey proteins, reducing their solubility in water. Consequently, roller-dried milk powder has a significantly lower solubility index compared to spray-dried powder, which is dried rapidly at lower temperatures.

68. (C) Large lactose crystals from improper cooling and lack of seeding.
The sandiness defect in sweetened condensed milk is caused by the presence of large, coarse lactose crystals. To prevent this, the concentrated milk must be cooled rapidly and seeded with fine lactose powder under agitation. Seeding induces the formation of numerous tiny crystals that are imperceptible to the tongue, whereas improper cooling leads to slow, uncontrolled crystal growth.

69. (A) Phosvitin
Egg albumen, or egg white, contains a variety of functional proteins, including ovalbumin, conalbumin, lysozyme, and ovomucoid, which contribute to its foaming and gelling properties. In contrast, phosvitin is a highly phosphorylated, iron-binding phosphoprotein that is located exclusively within the egg yolk, where it serves as a nutrient source for the developing embryo.

70. (A) 4, 1, 2, 3, 5
An egg's structure begins externally with the calcareous shell. Beneath the shell lie the inner and outer shell membranes, which surround the albumen. The albumen consists of thin and thick layers that envelope the vitelline membrane. This membrane directly encloses the yolk, which contains the germinal disc at its core, completing the structural sequence from outer shell to inner yolk.

71. (B) Agglomeration of particles by re-wetting and re-drying to improve water dispersion.
Instantization is a technological process designed to improve the reconstitutability of milk powder. The fine powder particles are exposed to a humid atmosphere to slightly moisten their surfaces, causing them to stick together and form larger, porous agglomerates. These agglomerates are then gently re-dried. This porous structure allows water to quickly penetrate the powder, facilitating rapid dispersion.

72. (C) The yolk contains approximately 100% of the egg's fat and a significant portion of its protein.
An average whole egg contains nutrients distributed unevenly between the albumen and yolk. The yolk holds almost all of the egg's lipids, including fat-soluble vitamins and cholesterol, as well as approximately forty percent of the total protein content. The albumen contains no fat and is primarily composed of water and proteins, while eggs lack any significant carbohydrate content.

73. (D) Adding stabilising salts like disodium phosphate before sterilisation.
Age gelation in evaporated milk is a physical defect where the concentrated proteins form a gel network during storage. This is prevented by adding stabilising salts, such as disodium phosphate or sodium citrate, before thermal sterilisation. These salts adjust the ionic balance and stabilize casein micelles, preventing their aggregation and extending the physical shelf stability of the canned product.

74. (B) 9.6%
Skimmed milk powder with four percent moisture contains ninety-six percent total solids. Therefore, ten kilograms of this powder contains nine point six kilograms of solids. Reconstituting this with ninety kilograms of water yields a total mixture weight of one hundred kilograms. The resulting total solids percentage is calculated as nine point six kilograms divided by one hundred kilograms, which is exactly nine point six percent.

NODIA

75. (B) High moisture powder from incomplete drying, which encourages microbial growth.
In spray drying, a drop in the outlet air temperature indicates that the thermal energy supplied was insufficient to evaporate all the water from the atomised droplets. This imbalance yields a powder with an excessively high moisture content. High moisture increases water activity in the product, compromising shelf life and creating a food safety hazard by encouraging rapid microbial growth.

76. (B) Egg weight and thick albumen height.
The Haugh unit is a standard mathematical index used to evaluate the freshness and internal quality of eggs. Its calculation relies on two physical measurements: the overall weight of the intact egg and the height of the thick albumen surrounding the yolk. A higher Haugh unit score indicates a firmer albumen, which is a key characteristic of fresh eggs.

38. (D) Excessive acid development before draining off the whey.
During cheese making, monitoring the rate of acid development is critical. If the starter culture produces excessive lactic acid before the whey is drained, it causes excessive demineralisation of the casein micelles, losing colloidal calcium phosphate. This loss weakens the protein matrix, resulting in a final cheese with a highly crumbly, brittle texture and an unpleasantly sour taste.

39. (B) To distribute salt evenly throughout the matrix.
Cutting the coagulated milk curd dramatically increases the surface-area-to-volume ratio of the curds. This step is essential to facilitate the rapid expulsion of whey via syneresis, which directly controls the moisture content and final texture of the cheese. Salting is a separate processing step performed later, after the whey has been completely drained from the vat.

40. (A) 1, 2, 3, 4, 5
Commercial yoghurt production begins with homogenising milk to stabilize fat. The milk is then pasteurised at 85 to 90 °C for 15 to 30 minutes to denature whey proteins. After cooling the mix to the inoculation temperature of 42 to 45 °C, starter cultures are added. Finally, the inoculated milk is incubated and cooled.

41. (D) Stacking and turning warm curd blocks to promote drainage and acid development.
Cheddaring is a unique processing step in Cheddar cheese manufacture. It involves cutting the drained curd into blocks, which are then repeatedly stacked, turned, and inverted at a controlled warm temperature. This physical manipulation promotes continuous whey drainage, compresses the curd particles into a cohesive structure, and allows the starter cultures to achieve the desired acidity level.

42. (A) Soluble calcium is required for para-casein micelle aggregation.
Enzymatic cheese coagulation occurs in two phases. First, chymosin cleaves kappa-casein, destroying its protective steric barrier. Second, soluble calcium ions are required to bridge the modified para-casein micelles, allowing them to aggregate into a continuous three-dimensional gel network. Insufficient soluble calcium leads to a weak coagulum, which can be corrected by adding food-grade calcium chloride.

43. (B) To denature whey proteins so they interact with casein to form a firmer gel.
High heat treatment of milk intended for yoghurt manufacture denatures whey proteins, primarily beta-lactoglobulin. These denatured proteins physically associate with kappa-casein on the surface of casein micelles. This interaction increases the water-holding capacity of the protein network, significantly strengthening the acid-induced gel structure and effectively preventing whey syneresis in the final fermented product.

44. (B) The milk contained residual antibiotics that inhibited starter culture growth.
Lactic acid starter cultures are highly sensitive to antimicrobial residues in milk. If the raw milk supply contains residual antibiotics from veterinary treatments, these compounds will directly inhibit or kill the inoculated Streptococcus thermophilus and Lactobacillus bulgaricus cultures. This inhibition stalls the fermentation process, preventing sufficient lactic acid production and leaving the milk at an abnormally high pH.

45. (A) Aging the cheese at above 1.7 °C for a minimum of 60 days.
To control pathogens, food safety regulations mandate that cheese manufactured from raw, unpasteurised milk must be aged at a temperature not less than 1.7 °C for a minimum of sixty days. The combination of acid development, salt concentration, moisture loss, and competitive microbiota during this sixty-day ripening period naturally inactivates vegetative pathogens like Salmonella and Escherichia coli.

46. (B) 80%
Food safety regulations, including those of the Food Safety and Standards Authority of India, mandate that commercial table butter must contain a minimum of 80% milk fat by weight. The remaining percentage consists of water, salt, and milk solids-not-fat. This strict composition standard ensures the desired physical texture, stability, and nutritional profile of the butter.

47. (D) I, II, III, and IV
Churning cream involves vigorous mechanical agitation that ruptures the fat globule membranes, releasing liquid fat that glues the remaining fat crystals together. This induces a phase inversion from an oil-in-water emulsion to a water-in-oil emulsion. The aqueous phase is drained as buttermilk. Working the butter further disperses

Downloaded from www.pdf.tube

the detection of hairline shell fractures, blood or meat spots, yolk positioning, and the size of the air cell without damaging the egg.

87. (B) Desugarised egg white powder has excellent, long-term ambient storage stability.
Dried egg white powder possesses exceptional long-term stability at room temperature, provided it undergoes desugarisation prior to spray drying. Removing the naturally occurring glucose prevents the Maillard browning reaction during storage. This preserves the functional properties of the proteins, such as foaming and gelling, and prevents the development of off-flavors and off-colors over extended storage periods.

88. (C) Vaccination of laying flocks and strict biosecurity.
Salmonella Enteritidis can infect the ovaries of laying hens, contaminating the yolk and albumen before the shell is formed. Because this contamination occurs internally, post-lay shell washing is ineffective. Implementing strict biosecurity measures and vaccinating the laying flocks are the most effective farm-level interventions to prevent the systemic infection of hens and ensure egg safety.

89. (D) The scores will decrease, indicating thinner albumen.
Both the aging of laying hens and exposure to chronic high environmental temperatures negatively affect egg quality. These factors reduce the secretion of mucin, a key glycoprotein that gives the thick albumen its gel-like structure. Consequently, the freshly laid eggs will have thinner albumen, resulting in lower measured albumen heights and decreased Haugh unit scores.

90. (A) Salmonella species
Salmonella species are the primary public health hazard associated with raw liquid eggs. Because of this high risk, food safety regulations mandate specific thermal pasteurisation processes, such as heating liquid whole egg to 60 °C for 3.5 minutes. This specific time-temperature combination is designed to achieve a significant reduction in viable Salmonella cells without coagulating the delicate proteins.

91. (C) 5.4 - 5.7
After slaughter, the cessation of blood flow deprives muscle tissue of oxygen, triggering anaerobic glycolysis. This biochemical pathway converts glycogen into lactic acid, causing the muscle pH to fall. In normal mammalian carcasses, this accumulation of lactic acid continues until glycogen reserves are depleted, resulting in an ultimate post-rigor pH of 5.4 to 5.7.

92. (B) II and III only
Ante-mortem inspection is designed to identify diseased or compromised animals prior to slaughter. Observations of vesicular lesions on the snout and hooves, accompanied by profuse salivation, are signs of infectious foot-and-mouth disease, justifying immediate condemnation. Severe emaciation and lethargy also indicate systemic illness, requiring the animal to be isolated as a suspect and withheld from slaughter.

93. (A) Deboning and freezing meat before rigor mortis ensures maximum tenderness.
Freezing meat prior to the completion of rigor mortis is highly undesirable. When such pre-rigor meat is thawed, the sudden release of calcium ions triggers massive muscle contractions. This phenomenon, known as thaw shortening, causes extreme muscle toughening and a significant loss of water-holding capacity, yielding dry, tough meat instead of the desired tender texture.

94. (A) P-II, Q-IV, R-I, S-III
Stunning renders the animal unconscious to prevent pain, while exsanguination involves severing major vessels to drain blood. Evisceration is the sanitary removal of internal organs from the abdominal and thoracic cavities to prevent microbial contamination. Splitting cut the carcass along the backbone into two symmetric halves, which facilitates rapid chilling and subsequent carcass evaluation.

95. (D) Electrical stunning – Commonly used for pigs and poultry
Electrical stunning is a widely accepted commercial method used primarily for pigs and poultry. It passes an electrical current through the brain to induce immediate, reversible unconsciousness prior to bleeding. Conversely, captive bolt stunning is standard for cattle, carbon dioxide stunning is used for pigs, and pithing is generally banned due to food safety and animal welfare concerns.

96. (A) Both Statement I and Statement II are correct.
Carcass ageing involves holding the meat at refrigerated temperatures for an extended period.

NODIA

This process allows endogenous proteolytic enzymes, primarily calpains and cathepsins, to slowly degrade key structural proteins within the muscle fibers, such as titin and desmin. This enzymatic breakdown weakens the myofibrillar structure, resulting in a significant and highly desirable increase in meat tenderness.

97. (A) Both A and R are true and R is the correct explanation of A.
Electrical stimulation of beef carcasses immediately post-mortem accelerates the glycolytic rate, rapidly converting glycogen to lactic acid and depleting cellular ATP. This process forces the early onset of rigor mortis. By lowering the muscle pH before the carcass temperature drops below 10 °C, electrical stimulation effectively prevents cold shortening, thereby ensuring tenderness in the meat.

98. (D) Chronic pre-slaughter stress depleting muscle glycogen stores.
Chronic pre-slaughter stress, such as long-distance transport or fighting, depletes muscle glycogen reserves in the live animal. Because glycogen is scarce at slaughter, anaerobic glycolysis is limited, producing very little lactic acid. Consequently, the muscle pH remains high, resulting in an ultimate pH of around 6.6. This high pH produces dark, firm, and dry meat.

99. (A) Localized bruising on one leg.
During post-mortem inspection, systemic diseases like generalized tuberculosis, septicemia, or anthrax require the immediate condemnation and destruction of the entire carcass to protect public health. In contrast, a localized injury, such as a bruise on a single limb, only requires trimming and discarding the affected tissue, allowing the rest of the carcass to pass for consumption.

100. (A) 2, 4, 3, 1, 5
Commercial cattle slaughter follows a strict hygienic sequence. The process begins with stunning to render the animal insensible, followed by shackling and exsanguination. Next, the hide is removed to expose the carcass, and evisceration is performed to extract the internal organs. Finally, the carcass is split into halves, washed thoroughly, and transferred to the chiller.

101. (A) Ratio of hot carcass weight to live animal weight, as a percentage.
Dressing percentage is an important economic metric in the meat industry, calculated as the weight of the hot dressed carcass divided by the live weight of the animal before slaughter, expressed as a percentage. This value represents the proportion of the animal that yields consumable meat and bone, excluding the head, hide, feet, and internal organs.

102. (D) Severe muscle toughening when a pre-rigor carcass is chilled below 10 °C while ATP remains.
Cold shortening is a physical defect that occurs when pre-rigor muscle is chilled below 10 °C before its pH drops below 6.0 and while ATP is still available. Under these cold conditions, the sarcoplasmic reticulum fails to bind calcium, triggering massive release of calcium ions. This causes severe myofibrillar contraction, leading to extreme and irreversible meat toughening.

103. (B) To retard growth of pathogens and spoilage organisms.
Chilling carcasses rapidly post-mortem is crucial to lower the surface temperature of the meat below 4 °C. This rapid temperature reduction directly retards the growth of mesophilic pathogens, such as Salmonella and Escherichia coli, and slows down the activity of spoilage bacteria. This thermal control is essential to ensure food safety and extend overall shelf life.

104. (C) Calcium (Ca^{2+})
Calpains are intracellular, calcium-dependent cysteine proteases responsible for the natural post-mortem tenderisation of meat during ageing. These enzymes require specific concentrations of calcium ions, which are naturally released from the sarcoplasmic reticulum after death. Once activated, calpains selectively degrade key structural proteins within the myofibrils, which weakens the muscle fiber structure and improves tenderness.

105. (D) Evidence of localized or systemic infections like tuberculosis.
During post-mortem inspection, lymph nodes act as sentinel organs that filter lymphatic fluid and react to pathogens. Examining the mandibular and mesenteric lymph nodes allows inspectors to check for localized or systemic inflammatory reactions, abscesses, or granulomatous lesions. These findings are indicators of infections, such

Click Here to Buy book on Amazon

as bovine tuberculosis or salmonellosis, which require carcass condemnation.

106. (B) 200 ppm
Sodium nitrite is a highly effective curing agent, but it is strictly regulated because high concentrations present toxicological risks. Food safety authorities, including the FSSAI, establish a maximum permitted residual limit of two hundred parts per million in cured meat products. This limit ensures microbial safety, particularly against Clostridium botulinum, while minimizing consumer exposure to carcinogenic nitrosamines.

107. (A) I adds flavor and preserves; II provides color and prevents botulism; III accelerates color formation; IV tempers harshness of salt.
Each curing ingredient serves a specific purpose. Sodium chloride preserves by lowering water activity and adds flavor. Sodium nitrite provides the pink color and prevents Clostridium botulinum growth. Sodium ascorbate is a reducing agent that accelerates nitric oxide formation. Sucrose acts as a flavoring agent that tempers the harshness of high salt concentrations in the meat.

108. (B) Adding ice/water during chopping is primarily done to dilute the salt concentration.
In meat emulsion processing, adding ice or cold water is critical for temperature control. The high-speed chopping blades generate substantial frictional heat. If the temperature exceeds 15 °C, the fat particles will melt and cause emulsion breakdown, or "fatting out," during cooking. Therefore, ice is added to absorb this heat and keep the emulsion stable during processing.

109. (A) P-III, Q-II, R-I, S-IV
Fresh sausages, like breakfast pork links, are uncooked and unsmoked. Cooked smoked sausages, such as frankfurters, are fully cooked and smoked during processing. Dry fermented sausages, like salami, rely on lactic acid fermentation and drying for preservation. Whole muscle cured products, such as prosciutto or bacon, are made from intact cuts that are cured and dried.

110. (C) Marbling – Intramuscular fat that contributes to juiciness and flavor
Marbling refers to the visible flecks of intramuscular fat dispersed within the lean muscle fibers. This fat plays a crucial role in meat quality, as it melts during cooking to lubricate the muscle fibers, significantly contributing to the juiciness, tenderness, and flavor of the meat. Conversely, connective tissue like collagen is responsible for toughness, not marbling.

111. (A) Both Statement I and Statement II are correct.
Smoking meat products imparts desirable sensory characteristics, such as a distinct smoky flavor and a rich mahogany color. Beyond these aesthetic attributes, the thermal smoke contains chemical compounds, including phenols, carbonyls, and organic acids. These compounds exhibit antimicrobial and antioxidant activities on the meat surface, which effectively delays lipid oxidation and inhibits bacterial growth, extending shelf life.

112. (A) Both A and R are true and R is the correct explanation of A.
Sodium ascorbate and erythorbate are strong reducing agents added to curing mixtures. They accelerate the chemical reduction of nitrite to nitric oxide, which speeds up the development of the cured pink color. Additionally, by reducing the concentration of residual free nitrite in the meat, these compounds significantly inhibit the formation of carcinogenic nitrosamines during high-temperature cooking.

NODIA

113. (B) Photo-oxidation of nitrosylhemochrome due to light and residual oxygen.
The pink color of cured meat is due to nitrosylhemochrome, a pigment formed during thermal processing. This pigment is highly sensitive to light and oxygen. When vacuum-packaged ham is exposed to intense retail display lighting, even trace amounts of residual oxygen can trigger photo-oxidation of the pigment. This reaction converts nitrosylhemochrome into brown metmyoglobin, causing color fading.

114. (D) Mortadella
Dry and semi-dry sausages, such as chorizo, salami, and summer sausage, are fermented by lactic acid bacteria and dried to reduce water activity. In contrast, Mortadella is a cooked, smoked, emulsion-style Italian sausage. It does not undergo bacterial fermentation or drying, and it contains high moisture levels, requiring continuous refrigeration to prevent microbial spoilage.

77. (A) I and IV only
Grade AA or A eggs are characterised by high internal quality. During candling, fresh eggs exhibit a small air cell depth of less than three millimeters and a clear, firm albumen that keeps the yolk centered, making its outline indistinct. Prominent yolk outlines or visible blood spots are signs of physical degradation, indicating lower quality or older eggs.

78. (C) Relative humidity in the egg storage room should be kept low (around 40%) to prevent mold growth on the shells.
Commercial storage of shell eggs requires high relative humidity, typically between seventy and eighty percent. Low humidity causes rapid moisture loss through the porous shell, which enlarges the internal air cell and degrades quality. While extremely high humidity can promote mold, a controlled seventy to eighty percent level balance is necessary to prevent excessive dehydration of the egg contents.

79. (A) P-IV, Q-I, R-III, S-II
Desugarisation removes glucose using enzymes to prevent Maillard browning during drying. Liquid whole eggs are heat-sensitive, requiring mild pasteurisation temperatures to avoid coagulation. Albumen powder is utilized in baking for its exceptional foaming properties. Frozen egg yolk requires salt or sugar addition to disrupt lipoprotein aggregation and prevent gelation, ensuring it remains fluid upon thawing.

80. (C) Oil coating – Spraying eggs with mineral oil to seal pores.
Oil coating is an effective post-washing sanitisation step in the egg industry. Spraying washed eggs with food-grade mineral oil seals the microscopic pores in the eggshell. This barrier minimizes the evaporation of water and carbon dioxide, significantly extending shelf life and preventing the penetration of external spoilage bacteria and molds into the egg interior.

81. (A) Both Statement I and Statement II are correct.
Liquid egg white proteins, particularly conalbumin and ovalbumin, are highly sensitive to thermal treatment. They begin to denature and coagulate at lower temperatures than the lipid-protein complexes found in egg yolk. Consequently, egg white must be pasteurised using milder temperature parameters to ensure the destruction of pathogens without causing protein coagulation or compromising functional whipping properties.

82. (A) Both A and R are true and R is the correct explanation of A.
Desugarisation is a critical pre-drying processing step for egg whites. Albumen naturally contains trace amounts of glucose. During the spray drying process and subsequent storage, this reducing sugar reacts with the amino groups of egg proteins in a Maillard reaction. This reaction causes severe brown discoloration, undesirable off-odors, and a significant reduction in protein solubility.

83. (A) Iron from the yolk reacting with hydrogen sulfide from the albumen during heating.
The greenish-black ring around the yolk of hard-boiled eggs is caused by a chemical reaction during prolonged heating. Heat denatures the sulfur-containing proteins in the albumen, releasing gaseous hydrogen sulfide. This gas diffuses inward and reacts with iron ions present in the yolk, forming ferrous sulfide, a dark precipitate that deposits at the yolk-albumen interface.

84. (C) Exact cholesterol content of the yolk
Standard grading of shell eggs is based on physical and aesthetic attributes. Examiners evaluate shell cleanliness, thickness, and soundness, alongside internal characteristics such as air cell depth, yolk centering, and albumen clarity. However, the exact cholesterol content of the yolk is a physiological variable that cannot be measured during standard commercial grading and has no legal impact on grade assignment.

85. (A) Protein aggregation causing irreversible gelation and a gummy texture upon thawing.
Freezing pure liquid egg yolk below -6 °C causes an irreversible physical change called gelation. Water molecules freeze into ice, forcing the yolk's low-density lipoproteins to come into close contact and aggregate. Upon thawing, the yolk loses its fluid nature and develops an undesirable, thick, gummy texture. Adding salt or sugar before freezing prevents this aggregation.

86. (D) Passing eggs over a bright light source to visually inspect internal quality and cracks.
Candling is an essential non-destructive inspection method used in the poultry industry. By passing intact shell eggs over a highly concentrated, bright light source, inspectors can visually evaluate internal quality. This process allows for

Downloaded from www.pdf.tube

and bacterial spores, producing a commercially sterile and shelf-stable product.

125. (A) Melanosis – Black spots in shrimp from polyphenol oxidase.
Melanosis, or black spot formation, is a common post-harvest defect in crustaceans such as shrimp and lobsters. It is a non-bacterial, enzymatic process driven by polyphenol oxidase. In the presence of oxygen, this enzyme oxidizes phenolic compounds into quinones, which polymerize into dark melanin pigments, causing unsightly black spots on the shell and head.

126. (A) Both Statement I and Statement II are correct.
Scombroid poisoning is a foodborne illness caused by eating spoiled fish containing high levels of histamine. Scombridae fish naturally have high levels of free histidine in their muscles. When stored at warm temperatures, spoilage bacteria containing the enzyme histidine decarboxylase proliferate and convert histidine into heat-stable histamine, which survives subsequent cooking or canning processes.

127. (A) Both A and R are true and R is the correct explanation of A.
Post-harvest shrimp are frequently treated with sodium bisulfite dips to prevent the enzymatic browning defect known as melanosis. Bisulfite acts as a strong reducing agent and competitive inhibitor of polyphenol oxidase, halting the oxidation of phenolic substrates into dark melanin pigments. This treatment preserves the visual quality and commercial value of the seafood.

128. (C) Post-processing contamination by mesophilic spoilage bacteria through micro-leaks in the can seams.
Swollen cans accompanied by a putrid odor typically indicate active gas-producing microbial fermentation. If the thermal process was designed to destroy Clostridium botulinum spores, survival of mesophils is unlikely. Instead, this defect usually arises from post-processing contamination, where cooling water or handling introduces mesophilic bacteria through temporary micro-leaks in the double seams during cooling.

129. (B) Brine immersion freezing at -40 °C
Chilling caught fish onboard vessels is critical to preserve quality, utilizing methods like flake ice, chilled seawater, or refrigerated seawater systems, which hold temperatures near 0 °C without freezing. In contrast, brine immersion at -40 °C is a freezing method, not a chilling method. Freezing onboard is used for long-term storage but is not classified as chilling.

130. (A) 2, 5, 3, 4, 1
Fish canning follows a systematic flow. It begins with dressing, which includes beheading, gutting, and cleaning. The fish is then pre-cooked to shrink the meat and filled into cans. Next, exhausting removes air from the head space, followed by seaming to seal the can hermetically. Finally, retort heating is executed to achieve commercial sterility.

131. (A) Washed and stabilised minced fish paste used to make structured seafood.
Surimi is an intermediate industrial product made from minced fish flesh, typically from lean white species like Alaska pollock. The mince is washed repeatedly with cold water to remove blood, fat, pigments, and water-soluble proteins, concentrating the myofibrillar proteins. Cryoprotectants are then added before freezing to stabilize the protein paste for restructured seafood manufacture.

132. (C) Calpains and cathepsins contribute to softening of fish muscle.
Post-mortem changes in fish begin with autolysis, which is driven by endogenous enzymes rather than bacteria. Proteolytic enzymes, such as calpains and cathepsins, degrade the structural proteins of the muscle, causing softening. Early autolytic degradation of adenosine triphosphate into inosine monophosphate actually contributes to the desirable fresh flavor, before further breakdown to hypoxanthine causes bitterness.

NODIA

133. (A) Depuration in tanks of clean, circulating, sterilized seawater.
Bivalve molluscs are filter feeders that accumulate bacteria, viruses, and impurities from their environment. Depuration is a biological process where harvested live shellfish are held in tanks of clean, continuously circulating, ozone- or ultraviolet-sterilized seawater. This environment encourages the animals to naturally purge contaminants from their digestive tracts, rendering them safe for raw consumption.

16. Who among the following is widely recognized as the inventor of the canning process?
(A) Louis Pasteur
(B) Clarence Birdseye
(C) Alexander Fleming
(D) Nicolas Appert

17. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Retort processing of low-acid foods is strictly carried out under pressure rather than in open boiling water.
Reason (R): Water boiling at atmospheric pressure cannot exceed 100°C, which is insufficient to destroy Clostridium botulinum spores within a practical timeframe.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

18. Which of the following is a correct statement regarding hermetic sealing in food packaging?
(A) It allows gas exchange while preventing microbial entry.
(B) It relies on vacuum pressure to keep containers closed.
(C) It blocks the entry of microorganisms, gases, and moisture.
(D) It applies to metal cans and not to glass jars or pouches.

19. Match the canning defects in List I with their primary causes in List II:
List I: (Canning Defect)
P. Hydrogen swell
Q. Flipper
R. Flat sour spoilage
S. Sulfide stinker
List II: (Primary Cause)
I. Desulfotomaculum nigrificans
II. Acid reaction with metal can
III. Geobacillus stearothermophilus
IV. Slight loss of vacuum, can ends bulge on striking
(A) P-II, Q-IV, R-III, S-I
(B) P-I, Q-II, R-IV, S-III
(C) P-IV, Q-III, R-I, S-II
(D) P-III, Q-I, R-II, S-IV

20. Which of the following is NOT a recognized mechanism by which refrigeration extends the shelf life of food?
(A) Retarding the growth and reproduction of mesophilic microorganisms.
(B) Slowing down the rate of enzymatic degradation.
(C) Decreasing the respiration rate of fresh fruits and vegetables.
(D) Completely halting all chemical oxidation reactions.

21. Consider the following statements regarding chilling injury in fruits and vegetables:
I. It occurs when susceptible produce is stored below its critical temperature but above freezing.
II. Bananas and tomatoes are highly susceptible to chilling injury.
III. Symptoms include surface pitting, internal discoloration, and failure to ripen.
IV. Chilling injury is caused by the formation of large ice crystals in the plant cells.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I and IV only
(D) I, II, III, and IV

22. In the context of canned foods, 'commercial sterility' is best defined as:
(A) The absolute destruction of all viable microorganisms, vegetative cells, and bacterial spores.
(B) The reduction of vegetative pathogens to safe levels while allowing some thermophilic spores to remain.
(C) The inactivation of public health pathogens and organisms capable of growing under normal storage.
(D) The elimination of anaerobic spoilage organisms using specialized chemical preservatives inside the can.

23. Arrange the following steps of the canning process in the correct chronological order:
I. Exhausting
II. Thermal Processing (Retorting)
III. Filling and Sealing
IV. Cooling
(A) I, III, II, IV
(B) III, I, II, IV
(C) III, II, I, IV

Click Here to Buy book on Amazon

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

refreezing forms large, sharp ice crystals that rupture muscle cells. Upon subsequent thawing, this cellular damage results in severe drip loss, texture degradation, and thick frost.

144. (C) The exact farm milking location.
Standard food labelling regulations mandate that processed cheese packages display the net weight, official FSSAI registration number, and a nutrition information panel to ensure consumer transparency and safety. However, declaring the exact farm milking location is not a mandatory legal requirement, as milk is typically pooled from multiple dairy farms before processing.

145. (B) Moisture migration and ice recrystallisation, causing freezer burn and texture loss.
Temperature fluctuations in frozen storage cause ice crystals within the food to melt slightly and then refreeze. This thermal cycling promotes recrystallisation, where small ice crystals merge into larger ones, damaging muscle fibers. Furthermore, it causes moisture migration from the food interior to the surface, leading to dehydration, surface discoloration, and freezer burn.

146. (D) An uninterrupted series of refrigerated activities and logistics maintaining low temperature.
A cold chain is defined as an uninterrupted series of refrigerated production, storage, distribution, and retail activities, along with associated equipment, designed to maintain perishable food products within a specific low-temperature range. Keeping this temperature control unbroken from harvest to consumption is essential to preserve nutritional quality, extend shelf life, and ensure microbiological safety.

147. (A) Fish and shellfish are major allergens that must be explicitly declared on labels.
Food safety regulations require clear packaging declarations for major food allergens. Fish and crustacean shellfish are globally recognized as potent allergens that can trigger severe, life-threatening immunological reactions. Consequently, their presence in any food product, even in trace amounts, must be explicitly declared on the label to warn sensitive consumers and prevent accidental exposure.

148. (C) Conducting challenge studies to prove the cook step achieves required Salmonella log reduction.
Validation is the process of obtaining scientific evidence that a food safety control measure, when properly implemented, is capable of controlling the identified hazard. Conducting microbial challenge studies or referencing scientific literature to prove that the cooking step consistently achieves the required log reduction of Salmonella is the correct method to validate this Critical Control Point.

149. (A) When Listeria monocytogenes could multiply to dangerous levels under refrigeration.
Listeria monocytogenes is a psychrotrophic pathogen that can multiply at refrigeration temperatures. Because pasteurised crab meat is a ready-to-eat product that does not receive further cooking, establishing its "Use By" date must focus on predicting when this pathogen could grow to dangerous levels under refrigerated storage, ensuring consumer safety throughout the product's shelf life.

150. (D) A failure of HACCP monitoring and a critical violation indicating record falsification.
Filling out Critical Control Point monitoring logs in advance is a severe violation of food safety protocols. HACCP records must reflect real-time observations and measurements to prove that hazards are under control. Pre-recording data indicates falsification of logs, which invalidates the safety system, prevents the detection of process deviations, and constitutes a critical regulatory failure.

www.nodia.in

Downloaded from www.pdf.tube

134. (D) Adenosine Triphosphate (ATP)
The K-value is a biochemical index used to quantify fish freshness. It tracks the step-by-step enzymatic breakdown of adenosine triphosphate, which degrades post-mortem into adenosine diphosphate, monophosphate, inosine monophosphate, inosine, and finally hypoxanthine. The K-value represents the ratio of the sum of inosine and hypoxanthine to the total sum of all ATP breakdown products.

135. (B) STPP increases moisture retention and texture; you must monitor weight and label added phosphates.
Sodium tripolyphosphate is used in shrimp processing to increase water-holding capacity, preventing weight and nutrient loss during thawing and cooking. However, because phosphates can be used to artificially increase weight by absorbing excess water, inspectors must monitor weight gain. Furthermore, food regulations mandate that added phosphates be clearly declared on the retail product label.

136. (C) HTST Pasteurisation
High Temperature Short Time pasteurisation is universally designated as a Critical Control Point in milk processing plants. This thermal step is specifically designed to eliminate biological hazards, such as Mycobacterium bovis and Coxiella burnetii. Critical limits, such as a minimum of 72 °C for 15 seconds, must be continuously monitored and verified to ensure safety.

137. (B) I, II, and III only
Proper cold chain management requires continuous temperature control to prevent microbial growth. Key practices include utilizing transport vehicles with temperature loggers, pre-cooling products to transport temperatures before loading, and using thermal blankets to protect products during transfer. Turning off refrigeration units during transit is a violation that causes temperature abuse, compromising food safety.

138. (A) Allergen declarations are strictly optional for dairy and egg products.
Food safety regulations mandate the clear declaration of major allergens on food packaging. Dairy and egg products are recognized as common allergens worldwide, and their presence must be explicitly declared on the label to protect consumers. Other mandatory requirements include descending ingredient lists, date markings, and the non-vegetarian brown dot or vegetarian green dot symbol.

139. (A) P-III, Q-II, R-I, S-IV
Conducting a hazard analysis identifies Listeria monocytogenes as a biological risk. Establishing critical limits involves setting the minimum cooking temperature to 71.1 °C. Establishing monitoring procedures requires logging the actual internal temperatures of processed sausage batches. Finally, establishing record-keeping procedures ensures that CCP logs and calibration records are maintained for traceability.

140. (B) Chilled fresh meat – Store between 0 °C to 4 °C
Storing chilled fresh meat between 0 °C and 4 °C is critical to retard the growth of spoilage microorganisms and foodborne pathogens while preventing freezing damage. Conversely, frozen fish requires storage below -18 °C, unopened UHT milk is shelf-stable at room temperature, and shell eggs must be kept refrigerated to maintain their internal physical quality.

141. (A) Both Statement I and Statement II are correct.
Under food safety and labelling standards in India, milk and dairy products are classified as vegetarian and must bear the green dot logo. In contrast, eggs and any food products containing egg ingredients are classified as non-vegetarian and are legally required to display the brown dot logo, assisting consumers in making informed dietary choices.

NODIA

142. (A) Both A and R are true and R is the correct explanation of A.
Traceability systems are mandatory in meat and seafood processing because they track products through all stages of production, processing, and distribution. If a contamination event or foodborne pathogen outbreak is detected, traceability enables the facility to quickly identify the raw material source, isolate affected batches, and execute an efficient product recall, protecting public health.

143. (D) Temperature abuse causing partial thawing, refreezing, and ice crystal damage.
A temperature rise to +5 °C during transit triggers partial thawing of frozen prawns. When the temperature is brought back down to -18 °C, the melted water refreezes slowly. This slow

the D-value tenfold.
(B) The total heating time required to destroy all bacterial spores.
(C) The fluid pressure required to destroy vegetative cells in food.
(D) The heating time required to reduce the microbial count by 90%.

8. Arrange the following microorganisms in the correct order of decreasing thermal resistance (most resistant to least resistant):
I. Vegetative cells of Salmonella
II. Spores of Geobacillus stearothermophilus
III. Spores of Clostridium botulinum
IV. Yeasts and Molds
(A) II, III, I, IV
(B) III, II, I, IV
(C) II, III, IV, I
(D) I, III, II, IV

9. Which of the following statements about enzyme activity in food preservation is incorrect?
(A) Polyphenol oxidase is responsible for enzymatic browning in cut fruits.
(B) Freezing completely and irreversibly destroys all inherent food enzymes.
(C) Blanching is an effective method to inactivate enzymes before freezing.
(D) Lowering the pH can inhibit the activity of many food spoilage enzymes.

10. In the following question, read the two statements and select the correct option:
Statement I: In hurdle technology, the synergistic effect of multiple hurdles requires lower intensities of individual preservation factors.
Statement II: The combination of hurdles disturbs the homeostasis of microorganisms, leading to metabolic exhaustion.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

11. Identify the correctly matched pair regarding thermal kinetics:
(A) Z-value – Temperature increase needed to reduce D-value tenfold
(B) F-value – Temperature required to achieve ninety percent microbial reduction
(C) D-value – Total processing time needed to reach commercial sterility
(D) C-value – Minimum fluid pressure required to lyse active bacterial cells

12. A food processor observes that frozen green peas develop an off-flavor and tough texture after three months of storage, despite maintaining a constant temperature of -18°C. Which processing error is the most likely cause of this quality defect?
(A) Excessively rapid freezing rates.
(B) Using a hermetically sealed package.
(C) Inadequate blanching time prior to freezing.
(D) Subjecting the peas to UV irradiation before freezing.

13. Identify the incorrectly matched pair regarding microorganisms and thermal processing:
(A) Clostridium botulinum – Target for low-acid canning
(B) Coxiella burnetii – Target organism for milk pasteurisation
(C) Bacillus coagulans – Responsible for flat sour spoilage
(D) Staphylococcus aureus – Highly heat-resistant spore former

14. When comparing HTST and LTLT pasteurisation of milk, the HTST method is preferred in large-scale operations primarily because:
(A) It utilizes a batch-type system that is much easier to monitor.
(B) It guarantees absolute destruction of all bacterial spores in milk.
(C) It minimizes nutritional loss while achieving equivalent lethality.
(D) It operates without continuous flow systems or complex exchangers.

15. Thermal death of microorganisms follows first-order kinetics. What is the direct effect of processing a food product at a higher temperature on the microbial destruction rate?
(A) The destruction rate decreases logarithmically.
(B) The destruction rate increases, leading to a shorter D-value.
(C) The destruction rate becomes completely independent of time.
(D) The microbial load remains static until the end of the holding time.

Click Here to Buy book on Amazon

than large, disruptive extracellular ones.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

33. Which of the following is a correct statement regarding "freezer burn" in frozen foods?
(A) It is a surface defect from ice sublimation due to moisture loss.
(B) It is caused by severe temperature drops leading to denaturation.
(C) It results from the fast growth of psychrotrophic microorganisms.
(D) It occurs primarily during rapid heating in commercial microwaves.

34. Match the freezing methods in List I with their characteristic equipment or media in List II:
List I: (Freezing Method)
P. Cryogenic freezing
Q. Air-blast freezing
R. Plate freezing
S. Immersion freezing
List II: (Equipment/Media)
I. High-velocity cold air circulation
II. Direct contact with hollow refrigerated metal shelves
III. Liquid nitrogen or carbon dioxide snow
IV. Dipping in a chilled brine or glycol solution
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-I, S-II
(D) P-III, Q-II, R-I, S-IV

35. Which of the following is NOT an advantage of fast freezing over slow freezing?
(A) Extended time in the zone of maximum ice crystal formation.
(B) Formation of smaller ice crystals.
(C) Reduced physical damage to cell structures.
(D) Decreased migration of water and localized solute concentration.

36. Consider the following statements comparing sun drying and hot air dehydration:
I. Sun drying is heavily dependent on weather conditions and risks contamination by dust and insects.
II. Hot air drying allows for precise control over temperature and humidity.
III. Sun drying generally requires high capital investment compared to hot air drying.
IV. Hot air drying is faster and produces a more uniform final moisture content.
Which of the above statements are correct?
(A) I, II, and III only
(B) I, II, and IV only
(C) II, III, and IV only
(D) I, III, and IV only

NODIA

37. The eutectic point during the freezing of a food system is defined as:
(A) The temperature at which the first extracellular ice crystal begins to form.
(B) The temperature below which no liquid solution remains in the food matrix.
(C) The temperature at which the specific heat of the food reaches its maximum.
(D) The temperature point where all academic and chemical activity ceases completely.

38. Arrange the periods of a typical hot air drying curve for a solid food item in the correct sequential order:
I. Falling rate period
II. Initial warming-up period
III. Constant rate period
(A) II, III, I
(B) I, II, III
(C) II, I, III
(D) III, II, I

39. Which of the following statements about hot air drying is incorrect?
(A) Moisture moves from the interior of the food to the surface during drying.
(B) Shrinkage of the food product is a common physical change.
(C) High temperatures can lead to loss of volatile flavor compounds.
(D) The drying rate is constant throughout the entire drying process.

40. In the following question, read the two statements and select the correct option:
Statement I: The glass transition temperature (T_g) is a critical parameter in predicting the stability of dehydrated foods.
Statement II: Storing a dehydrated food above its T_g increases molecular mobility, promoting caking, stickiness, and degradation reactions.
(A) Both Statement I and Statement II are correct.

(D) I, II, III, IV

24. Which of the following statements about retort pouches is incorrect?
(A) They require longer thermal processing times than metal cans of similar volume.
(B) They are constructed from multiple layers of high-barrier flexible materials.
(C) They have high surface-to-volume ratios, allowing rapid heat penetration.
(D) They must be processed with overriding pressure to prevent package bursting.

25. In the following question, read the two statements and select the correct option:
Statement I: High-acid foods (pH < 4.6) require less severe thermal processing than low-acid foods.
Statement II: Clostridium botulinum spores cannot germinate and produce toxin in environments with a pH below 4.6.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

26. Identify the correctly matched pair regarding food spoilage under refrigeration:
(A) Thermophiles – High-temperature organisms causing chilled meat spoilage
(B) Psychrotrophs – Organisms that grow well at refrigeration temperatures
(C) Mesophiles – Moderate-temperature organisms with optimum growth at zero degrees
(D) Halophiles – Salt-tolerant organisms that exclusively spoil frozen foods

27. A canned soup product exhibits severe swelling of both ends after one week of storage at room temperature. The product has a putrid odor upon opening. What is the most likely cause of this defect?
(A) Putrefactive anaerobic spoilage due to under-processing.
(B) Flat sour spoilage due to Geobacillus stearothermophilus.
(C) Inadequate exhausting leading to a physical swell.
(D) Chilling injury from improper post-retort cooling.

28. Identify the incorrectly matched pair regarding storage temperatures:
(A) Deep freezing – Below -18°C
(B) Chilling – Between 0°C and 8°C
(C) Refrigeration – Above 15°C
(D) Danger zone for bacterial growth – 5°C to 60°C

29. The F_0-value is a critical concept in retort processing. It standardizes the sterilizing value of a process by referencing which specific temperature and Z-value?
(A) 100°C with a Z-value of 5°C
(B) 135°C with a Z-value of 8°C
(C) 72°C with a Z-value of 10°C
(D) 121.1°C with a Z-value of 10°C

30. Rapid chilling of freshly slaughtered beef carcasses before the onset of rigor mortis can lead to a specific quality defect. What is the effect of this action?
(A) Excessive moisture loss on the carcass surface known as freezer burn.
(B) Accelerated lipid oxidation within fat layers causing rapid rancidity.
(C) Irreversible muscle contraction in fibers known as cold shortening.
(D) Immediate breakdown of cellular glycogen reserves into lactic acid.

31. In food freezing, the phenomenon where the freezing point of the food is lower than that of pure water is primarily due to:
(A) The unique physical structure of plant and animal cell membranes.
(B) The high concentration of dissolved solutes in the food matrix.
(C) The specific heat capacity of different lipids present in food.
(D) The rapid removal of latent heat of fusion during active freezing.

32. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Individual Quick Freezing (IQF) yields frozen foods of superior textural quality compared to slow freezing methods.
Reason (R): IQF promotes the formation of numerous, small intracellular ice crystals rather

Downloaded from www.pdf.tube

I. High-value temperature-sensitive items (e.g., instant coffee, berries)
II. Liquid foods to produce powders (e.g., milk, whey)
III. Viscous slurries or purees (e.g., mashed potato flakes)
IV. Solid food pieces in small-scale batch operations
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-III, Q-IV, R-I, S-II
(D) P-II, Q-III, R-I, S-IV

50. Which of the following is NOT a principle by which salting preserves food?
(A) Plasmolysis of microbial cells due to osmotic pressure.
(B) Reduction of water activity (a_w).
(C) Direct destruction of microbial spores through thermal stress.
(D) Interference with microbial enzyme activity due to high chloride ion concentration.

51. Consider the following statements regarding meat curing:
I. Sodium nitrite is primarily added to inhibit Clostridium botulinum.
II. Nitrites contribute to the characteristic pink color of cured meats.
III. Excessive use of nitrites can lead to the formation of carcinogenic nitrosamines.
IV. Sugar is added to curing mixtures solely to decrease water activity.
Which of the above statements are correct?
(A) I, II, and III only
(B) I, III, and IV only
(C) II, III, and IV only
(D) I, II, III, and IV

52. In the context of freeze drying, operating below the "triple point" of water is essential. The triple point is defined as:
(A) The stage where freezing, blanching, and drying occur simultaneously.
(B) The exact high-pressure threshold required to atomize liquid feeds.
(C) The low-temperature limit at which all free water becomes crystallized.
(D) The unique condition where water coexists as solid, liquid, and gas.

53. Arrange the typical stages of freeze drying in the correct sequence:
I. Primary drying (Sublimation)
II. Freezing
III. Secondary drying (Desorption)
(A) I, II, III
(B) II, I, III
(C) II, III, I
(D) III, II, I

54. Which of the following statements regarding osmotic agents is incorrect?
(A) Sucrose is widely utilized as the primary osmotic agent during the dehydration of fruits.
(B) Sodium chloride is commonly employed as a highly effective osmotic agent for vegetables.
(C) High molecular weight polymers penetrate food tissue faster than low molecular weight sugars.
(D) The choice of osmotic agent affects both mass transfer rates and the final product quality.

NODIA

55. In the following question, read the two statements and select the correct option:
Statement I: The addition of ascorbic acid (Vitamin C) or erythorbate in meat curing accelerates the reduction of nitrite to nitric oxide.
Statement II: Ascorbic acid promotes the formation of nitrosamines during high-heat cooking of cured meats.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

56. Identify the correctly matched pair regarding ingredients used in curing:
(A) Sodium nitrite – Acts as a powerful antimicrobial agent
(B) Sodium chloride – Fixes the red meat color
(C) Phosphates – Accelerate oxidation in meat products
(D) Sucrose – Primarily acts to increase the pH of meat

57. A batch of spray-dried milk powder exhibits severe clumping and sticks to the walls of the drying chamber. What operational parameter

(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

41. Identify the correctly matched pair regarding dehydration terms:
(A) Bound water – Moisture removed easily during the constant rate drying period
(B) Desorption isotherm – Represents moisture loss from food to the air
(C) Wet bulb temperature – Maximum air temperature achieved in a typical dryer
(D) Sublimation – Phase change of liquid water directly into a gaseous state

42. A processor utilizes a fluidized bed freezer to individually freeze green peas. What aerodynamic principle ensures the peas do not clump together?
(A) Extremely high vacuum pressure that removes all surface and internal moisture.
(B) An upward cold air current that suspends and freezes the peas simultaneously.
(C) The physical packing of the peas tightly between refrigerated metal plates.
(D) Continuous high-pressure spraying of liquid nitrogen over a stationary belt.

43. Identify the incorrectly matched pair regarding changes during freezing:
(A) Recrystallization – Improves texture of frozen foods during storage
(B) Solute concentration – Lowers the freezing point of unfrozen phases
(C) Ice crystal growth – Causes severe mechanical damage to cell membranes
(D) Osmotic shock – Leads to extensive cell dehydration in slow freezing

44. Dehydration preserves food primarily by reducing water activity (a_w). At approximately what a_w level is the growth of all pathogenic bacteria completely inhibited?
(A) 0.95
(B) 0.70
(C) 0.85
(D) 0.60

45. During rapid hot air drying of fruit chunks, the outer layer dries quickly and forms a rigid shell that traps moisture inside. This phenomenon is known as:
(A) Gelatinization
(B) Freezer burn
(C) Maillard browning
(D) Case hardening

46. In a spray drying process, the primary purpose of the atomizer is to:
(A) Evaporate the remaining moisture from the incoming hot air stream.
(B) Separate the ultra-fine dried powder from the exhausted process air.
(C) Disperse the liquid feed into fine droplets to increase surface area.
(D) Heat the incoming processing air to the required drying temperature.

47. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Freeze drying (lyophilization) causes minimal shrinkage and preserves the structural integrity of foods.
Reason (R): Water is removed by sublimation from the solid ice phase directly to vapor, bypassing the liquid phase.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

48. Which of the following is a correct statement regarding osmotic dehydration?
(A) It involves complete moisture removal from food using rapid hot air currents.
(B) It requires high operating temperatures maintained strictly above boiling point.
(C) It utilizes a low-concentration hypotonic solution to extract organic solutes.
(D) It removes water by immersing the food product in a hypertonic solution.

49. Match the drying technologies in List I with their typical applications in List II:
List I: (Drying Technology)
P. Spray drying
Q. Freeze drying
R. Drum drying
S. Cabinet drying
List II: (Typical Application)

Click Here to Buy book on Amazon

CHAPTER 17

Food Preservation: Principles, Methods and Emerging Technologies

NODIA

1. Which of the following best represents the primary principle of food preservation by lowering water activity?
(A) It renders free water unavailable for microbial growth.
(B) It permanently denatures heat-sensitive enzymes in food.
(C) It alters the pH level of the matrix to destroy cells.
(D) It accelerates chemical browning to produce inhibitors.

2. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Hurdle technology enhances food safety by employing multiple mild preservation factors rather than a single extreme one.
Reason (R): Microorganisms cannot overcome any single mild preservation factor when present in isolation.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

3. Which of the following is a correct statement regarding the process of blanching in vegetable preservation?
(A) Blanching inactivates spoilage enzymes before freezing.
(B) Blanching achieves commercial sterility in vegetables.
(C) Blanching uses high pressure to destroy endospores.
(D) Blanching reduces moisture content to extend shelf life.

4. Match the thermal preservation methods in List I with their standard time-temperature parameters in List II:
List I: (Thermal Preservation Method)
P. LTLT Pasteurisation
Q. HTST Pasteurisation
R. UHT Processing
S. Commercial Sterilisation
List II: (Time-Temperature Parameters)
I. 72°C for 15 seconds
II. 135-150°C for 2-5 seconds
III. 63°C for 30 minutes
IV. 121°C for 15 minutes (or equivalent F_0)
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-III, R-IV, S-II
(C) P-III, Q-II, R-I, S-IV
(D) P-IV, Q-I, R-II, S-III

5. Which of the following microorganisms is NOT typically targeted as the reference organism for establishing the commercial sterility of low-acid canned foods?
(A) Clostridium botulinum
(B) Lactobacillus bulgaricus
(C) Geobacillus stearothermophilus
(D) Clostridium sporogenes

6. Consider the following statements regarding Ultra-High Temperature (UHT) processing:
I. UHT processing typically operates between 135°C and 150°C.
II. UHT products require cold chain maintenance for extended shelf life.
III. UHT treatment completely avoids Maillard browning reactions in milk.
IV. Aseptic packaging is mandatory to maintain the sterility of UHT processed foods.
Which of the above statements are correct?
(A) I and II only
(B) I and IV only
(C) II, III, and IV only
(D) I, III, and IV only

7. The term 'D-value' in thermal preservation is defined as:
(A) The temperature increase needed to reduce

adjustment would most effectively resolve this issue?
(A) Decreasing the inlet air temperature.
(B) Decreasing the relative humidity of the exhaust air by adjusting drying temperatures.
(C) Increasing the feed flow rate.
(D) Increasing the exhaust air temperature to ensure operation above the glass transition temperature.

58. Identify the incorrectly matched pair regarding dehydration methods and mass transfer:
(A) Osmotic dehydration – Driven by concentration gradients
(B) Hot air drying – Driven by thermal radiation only
(C) Freeze drying – Driven by vapor pressure gradients
(D) Spray drying – Enhanced by massive surface area generation

59. When fresh strawberries are immersed in a highly concentrated sucrose solution (hypertonic) for osmotic dehydration, what is the primary mass transfer phenomenon?
(A) Water moves out of the strawberry, and sugar moves into the strawberry.
(B) Water moves into the strawberry, and sugar moves out of the strawberry.
(C) Only water moves out; the strawberry membrane is completely impermeable to sugar.
(D) Sugars polymerize on the surface without penetrating the fruit.

60. The formation of nitrosamines in cured meats is a significant food safety concern. Which cooking method most strongly induces this chemical reaction?
(A) Boiling
(B) Steaming
(C) High-temperature frying
(D) Microwaving at low power

61. Which group of chemical compounds in wood smoke is primarily responsible for its antimicrobial and antioxidant properties?
(A) Carbohydrates
(B) Amino acids
(C) Triglycerides
(D) Phenolics

62. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Lactic acid fermentation is an effective traditional method for preserving vegetables like cabbage (sauerkraut).
Reason (R): The lactic acid bacteria lower the pH of the food, creating an environment inhospitable to pathogenic and spoilage microorganisms.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

63. Which of the following is a correct statement regarding alcoholic fermentation?
(A) It is primarily performed by Acetobacter species under aerobic conditions.
(B) Yeasts convert sugars into ethanol and carbon dioxide anaerobically.
(C) It leads to a highly significant increase in the pH of the food system.
(D) It requires the deliberate addition of nitrites to manage chemical rates.

64. Match the fermented foods in List I with their predominant fermenting microorganisms in List II:
List I: (Fermented Food)
P. Yogurt
Q. Wine
R. Vinegar
S. Sauerkraut
List II: (Fermenting Microorganism)
I. Saccharomyces cerevisiae
II. Lactobacillus bulgaricus and Streptococcus thermophilus
III. Leuconostoc mesenteroides and Lactobacillus plantarum
IV. Acetobacter aceti
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-IV, R-I, S-II
(D) P-II, Q-IV, R-I, S-III

NODIA

65. Which of the following is NOT a recognized function of Sulfur Dioxide (SO_2) in food preservation?
(A) Serving as a primary leavening agent in baked goods.
(B) Inhibiting enzymatic browning in fruits.

correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

116. Identify the correctly matched pair regarding non-thermal technology mechanisms:
(A) PEF – Inactivation via acoustic cavitation
(B) Ultrasound – Inactivation via electroporation
(C) UV light – Inactivation via free radical extraction
(D) HPP – Inactivation via isostatic pressure

117. A juice manufacturer implements PEF to pasteurize fresh apple juice. They observe arcing (sparking) inside the treatment chamber, leading to off-flavors. What is the most likely cause of this issue?
(A) The active juice has a very low pH.
(B) Entrapped gas bubbles in the juice.
(C) Temperature of juice below ten degrees.
(D) Applied pulse width was much too short.

118. Identify the incorrectly matched pair regarding ultrasound equipment:
(A) Piezoelectric transducer – Converts electrical energy into acoustic energy
(B) Sonotrode (Horn) – Amplifies and transmits ultrasound into the fluid
(C) Electroporator – Measures the frequency of ultrasound waves
(D) Magnetostrictive transducer – Generates ultrasound using magnetic fields

119. In optimizing a PEF process, ensuring that the electrical pulses are delivered efficiently depends on the electric field strength (kV/cm) and treatment time. Treatment time is calculated by:
(A) Total holding time in the storage tank.
(B) Flow rate divided by the applied voltage.
(C) Gap between electrodes divided by fluid density.
(D) Number of pulses multiplied by the pulse width.

120. The formation of extreme, localized "hot spots" (temperatures up to 5000 K) during acoustic cavitation leads to which secondary chemical effect in aqueous solutions?
(A) Sonolysis of water into hydroxyl radicals and hydrogen atoms.
(B) Rapid polymerization of active water molecules into heavy water.
(C) Instantaneous and complete crystallization of all dissolved sugars.
(D) Total conversion of dissolved molecular oxygen into pure ozone gas.

121. Microwave heating of foods is primarily achieved through which two mechanisms?
(A) Conduction and convection
(B) Dipolar rotation and ionic polarization
(C) Acoustic cavitation and electroporation
(D) Alpha decay and gamma absorption

122. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Ohmic heating provides uniform and rapid heating of particulate liquid foods (e.g., soups with vegetable chunks).
Reason (R): In Ohmic heating, heat is generated internally within the food matrix due to electrical resistance when an alternating current passes through it.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

123. Which of the following is a correct statement regarding Cold Plasma technology?
(A) It uses partially ionized gas with ions and electrons near room temperature.
(B) It consists of a fully ionized gas heated to high levels to destroy waste.
(C) It relies heavily on extreme hydrostatic pressure to maintain plasma states.
(D) It works by freezing the food surface instantaneously to kill all bacteria.

124. Match the electromagnetic heating methods in List I with their typical frequencies used in the food industry in List II:
List I: (Heating Method)
P. Microwave Heating
Q. Radio Frequency (RF) Heating
List II: (Typical Frequency)
I. 2450 MHz and 915 MHz
II. 27.12 MHz and 13.56 MHz
(A) P-I, Q-II

Downloaded from www.pdf.tube

(C) Heterofermentative LAB – Produce lactic acid, ethanol/acetic acid, and CO_2
(D) Acetobacter – Produces acetic acid

74. In the production of fermented dry sausages (like salami), the rapid drop in pH is critical for product safety. Which intrinsic property is primarily modified by this acidification to ensure safety?
(A) It drastically increases the overall water holding capacity of meat proteins.
(B) It coagulates meat proteins, aiding drying and restricting pathogen growth.
(C) It neutralizes added sodium nitrites to prevent chemical toxicity in food.
(D) It sterilizes the sausage product completely against all bacterial spores.

75. The addition of excessive sulfur dioxide to certain foods can lead to a significant nutritional defect. What is the most well-documented negative effect of SO_2 on vitamins?
(A) It cleaves and inactivates Vitamin B1 (Thiamine).
(B) It completely oxidizes and destroys Vitamin C.
(C) It rapidly breaks down lipid-soluble Vitamin E.
(D) It precipitates stable Vitamin D out of solution.

76. At what pH range is benzoic acid most effective as a food preservative?
(A) pH 6.0 - 7.5
(B) pH 8.0 - 9.5
(C) pH 2.5 - 4.0
(D) pH 5.0 - 6.5

77. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Sorbic acid and its salts are widely used as fungistats in cheeses and baked goods.
Reason (R): Sorbates effectively inhibit the germination and growth of molds and yeasts without significantly impacting beneficial lactic acid bacteria.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

78. Which of the following is a correct statement regarding food irradiation?
(A) It utilizes non-ionizing radiation to generate heat within food.
(B) It renders processed food radioactive for a short storage period.
(C) It requires displaying the "Radura" symbol on food packaging.
(D) It is an ineffective method for controlling insects in bulk grains.

79. Match the irradiation dosage levels in List I with their technical terms in List II:
List I: (Irradiation Level)
P. Radurization
Q. Radicidation
R. Radappertization
List II: (Technical Term)
I. High dose (10-50 kGy) for commercial sterility
II. Low to medium dose to eliminate specific non-spore-forming pathogens
III. Low dose to extend shelf life by reducing spoilage organisms
(A) P-III, Q-II, R-I
(B) P-I, Q-II, R-III
(C) P-II, Q-III, R-I
(D) P-III, Q-I, R-II

80. Which of the following is NOT a commonly used source for commercial food irradiation?
(A) Cobalt-60
(B) Cesium-137
(C) Electron beam accelerators
(D) Carbon-14

81. Consider the following statements comparing Electron-beam (E-beam) and Gamma irradiation:
I. Gamma rays have higher penetration depth than E-beams.
II. E-beam facilities require replenishment of radioactive isotopes.
III. E-beam accelerators can be turned off when not in use.
IV. Both methods utilize ionizing radiation.
Which of the above statements are correct?
(A) I, II, and IV only
(B) I, III, and IV only
(C) II, III, and IV only
(D) I, II, III, and IV

NODIA

99. Which of the following statements about active packaging components is incorrect?
(A) Ethylene absorbers are used to accelerate ripening of fruits.
(B) Oxygen scavengers are used to prevent lipid browning and mold.
(C) Carbon dioxide emitters are used to inhibit meat microbes.
(D) Moisture desiccants are used to control package humidity.

100. In the following question, read the two statements and select the correct option:
Statement I: High Pressure Processing (HPP) at ambient temperatures (400-600 MPa) effectively inactivates bacterial endospores to achieve commercial sterility.
Statement II: Spores are highly resistant to pressure; achieving commercial sterility via HPP requires pressure-assisted thermal sterilization (PATS).
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

101. Identify the correctly matched pair regarding packaging terminology in MAP:
(A) WVTR – Water Vapor Thermal Resistance
(B) OTR – Oxygen Transmission Rate
(C) Active Packaging – Unaltered air sealed within a standard polybag
(D) Permselectivity – Complete barrier to all gases

102. A butcher uses MAP for fresh beef steaks. If the gas mixture contains 80% O_2 and 20% CO_2, what is the primary purpose of this specific ratio?
(A) To create an anaerobic environment that completely stops Clostridium growth.
(B) To initiate non-enzymatic browning reactions during long-term cold storage.
(C) O_2 preserves the red color, while CO_2 inhibits aerobic spoilage bacteria.
(D) To reduce the water activity levels of the meat surface during packaging.

103. Identify the incorrectly matched pair regarding High Pressure Processing (HPP):
(A) Isostatic principle – Pressure is transmitted uniformly and instantaneously
(B) Le Chatelier's principle – Processes accompanied by a decrease in volume are enhanced by pressure
(C) Pascalization – Another term for High Pressure Processing
(D) Adiabatic cooling – The temperature of food significantly drops during the compression phase

104. During HPP, the temperature of water increases by approximately 3°C for every 100 MPa of applied pressure due to compression. If a food product initially at 20°C is subjected to 600 MPa, what is its approximate maximum temperature during the hold time?
(A) 38°C
(B) 23°C
(C) 60°C
(D) 120°C

105. High levels of CO_2 in MAP of fish can sometimes lead to an undesirable physical defect. What is this phenomenon?
(A) Irreversible conversion of active fish muscle proteins to oxymyoglobin.
(B) Package collapse and increased drip loss due to dissolved CO_2 gas.
(C) Sudden structural expansion of the package causing it to burst open.
(D) Rapid and undesirable calcification of fish bones during cold storage.

106. Pulsed Electric Field (PEF) technology inactivates microorganisms primarily through which physiological mechanism?
(A) Immediate thermal destruction of microbial DNA.
(B) Electroporation, forming pores in cell membranes.
(C) Chemical modification of essential amino acids.
(D) Complete extraction of intracellular bound water.

107. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Ultrasound processing enhances mass transfer processes such as osmotic dehydration and extraction.
Reason (R): Acoustic cavitation causes the

Click Here to Buy book on Amazon

(B) Argon, Helium, and Oxygen
(C) Carbon monoxide, Hydrogen, and Nitrogen
(D) Methane, Oxygen, and Carbon dioxide

92. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): High Pressure Processing (HPP) is considered a non-thermal preservation method.
Reason (R): HPP destroys microorganisms primarily through pressure-induced protein denaturation and cell membrane disruption, without significantly raising the bulk temperature of the food.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

93. Which of the following is a correct statement regarding Controlled Atmosphere Storage (CAS)?
(A) It involves sealing food in packaging to let respiration alter the atmosphere.
(B) It is exclusively utilized as a method for preserving high-fat processed meats.
(C) It employs high levels of pure oxygen to halt ripening in climacteric fruits.
(D) It involves continuous monitoring and dynamic adjustment of storage gases.

94. Match the gases used in MAP in List I with their primary functions in List II:
List I: (Gas Used)
P. Carbon dioxide (CO_2)
Q. Nitrogen (N_2)
R. High Oxygen (O_2)
List II: (Primary Function)
I. Acts as an inert filler gas to prevent package collapse
II. Maintains the bright red color of oxymyoglobin in fresh meat
III. Exhibits strong antimicrobial effects by dissolving in the aqueous phase
(A) P-III, Q-I, R-II
(B) P-I, Q-II, R-III
(C) P-II, Q-I, R-III
(D) P-III, Q-II, R-I

95. Which of the following is NOT an effect of High Pressure Processing (HPP) on food components?
(A) Disruption of non-covalent hydrogen and hydrophobic bonds in proteins.
(B) Destruction of covalent bonds in essential vitamins and flavor compounds.
(C) Inactivation of vegetative bacterial, yeast, and mold cells in foods.
(D) Gelation or physical modification of starch and protein matrices in foods.

96. Consider the following statements regarding MAP and CAS:
I. CAS is typically applied to large bulk storage (e.g., apple silos), while MAP is used for retail packaging.
II. In MAP, the initial gas mixture changes over time due to product respiration and film permeability.
III. CAS requires lower capital investment than MAP.
IV. Both MAP and CAS rely heavily on strict temperature control for efficacy.
Which of the above statements are correct?
(A) I, II, and III only
(B) I, II, and IV only
(C) II, III, and IV only
(D) I, III, and IV only

NODIA

97. Equilibrium Modified Atmosphere (EMA) packaging is primarily designed for fresh produce. It aims to achieve a steady-state gas composition by balancing:
(A) Respiration rate of produce and gas transmission rate of the film.
(B) Microbial degradation rate and active chemical oxidation rate of food.
(C) Temperature of storage and physical pressure inside sealed packages.
(D) Relative humidity of product and total vacuum pressure level applied.

98. Which of the following is the most appropriate fluid used to transmit pressure in commercial High Pressure Processing (HPP) systems?
(A) Pure liquid nitrogen maintained at extremely low temperatures.
(B) High-viscosity mineral oil formulated for hydraulic systems.
(C) Water mixed with a small amount of food-grade lubricant.
(D) Highly compressed air stored under extreme pressure levels.

82. The standard unit used to measure the absorbed dose of ionizing radiation in food processing is the:
(A) Sievert (Sv)
(B) Becquerel (Bq)
(C) Gray (Gy)
(D) Curie (Ci)

83. Which of the following statements best explains the limitation of Ultraviolet (UV) light in food preservation?
(A) It has low penetration, limiting its use to surface or air treatments.
(B) It generates significant levels of dangerous residual radioactivity in food.
(C) It causes immediate and highly extreme heating of treated liquid foods.
(D) It requires highly expensive radioactive isotopes to generate the light.

84. Which of the following statements regarding the solubility of chemical preservatives is incorrect?
(A) Sodium benzoate is highly soluble in water.
(B) Undissociated acid forms are generally more antimicrobial than their dissociated salts.
(C) Preservatives are often formulated as salts to improve solubility in aqueous food systems.
(D) Sorbic acid is more soluble in water than potassium sorbate.

85. In the following question, read the two statements and select the correct option:
Statement I: Irradiating food at the maximum permitted doses can induce significant radioactivity within the food matrix.
Statement II: The energy levels of Cobalt-60 gamma rays (1.17 and 1.33 MeV) are below the threshold required to induce radioactivity in food.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

86. Identify the correctly matched pair regarding chemical preservatives and their target organisms:
(A) Sorbates – Specifically target bacterial endospores in food
(B) Nitrites – Inhibit beneficial lactic acid bacteria in milk
(C) Natamycin – Target yeasts and molds on cheese surfaces
(D) Propionates – Target and destroy viruses in fresh produce

87. A regulatory inspector discovers that a batch of commercial potatoes has not sprouted despite six months of storage at ambient temperature. Chemical sprout inhibitors were not used. Which processing method was most likely applied?
(A) Radappertization process
(B) Liquid ozonation treatment
(C) Hot water blanching process
(D) Low-dose irradiation process

88. Identify the incorrectly matched pair regarding the chemical nature of preservatives:
(A) Sulfur dioxide – Long-chain organic polymer
(B) Benzoic acid – Aromatic carboxylic acid
(C) Sorbic acid – Straight-chain unsaturated fatty acid
(D) Propionic acid – Short-chain saturated fatty acid

89. The concept of Dose Uniformity Ratio (D_{max}/D_{min}) is crucial in food irradiation. What does a ratio close to 1.0 indicate?
(A) The food product has been subjected to severe over-processing.
(B) The radiation dose was absorbed uniformly throughout the food.
(C) The ionizing radiation failed to penetrate the outer packaging.
(D) The food product absorbed only low-penetration alpha particles.

90. The primary mechanism by which ionizing radiation destroys microorganisms in food is through direct damage to DNA and indirect damage caused by:
(A) The rapid and complete dehydration of the microbial cell.
(B) The generation of reactive oxygen species from water radiolysis.
(C) The immediate and irreversible coagulation of wall proteins.
(D) The physical crushing of cell membranes via pressure waves.

91. Modified Atmosphere Packaging (MAP) typically utilizes a mixture of which three primary gases?
(A) Oxygen, Carbon dioxide, and Nitrogen

Downloaded from www.pdf.tube

rapid formation and implosion of microbubbles, creating localized micro-jets and structural disruption (sponge effect).
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

108. Which of the following is a correct statement regarding the application of Pulsed Electric Field (PEF) in the food industry?
(A) It is primarily used for sterilizing dry powder products in bulk.
(B) It requires heating foods to processing temperatures above 100°C.
(C) It is highly effective for pumpable liquids like fruit juices.
(D) It is completely ineffective against vegetative bacterial cells.

109. Match the types of ultrasound in List I with their frequencies and applications in List II:
List I: (Type of Ultrasound)
P. Power Ultrasound (High intensity)
Q. Diagnostic Ultrasound (Low intensity)
List II: (Frequency & Application)
I. Frequencies $>$ 100 kHz; used for non-destructive quality analysis
II. Frequencies 20-100 kHz; used for cell disruption, homogenization, and extraction
(A) P-I, Q-II
(B) P-II, Q-I
(C) P-I, Q-I
(D) P-II, Q-II

110. Which of the following factors does NOT negatively impact the efficacy of PEF treatment in foods?
(A) High electrical conductivity of the food.
(B) Presence of air bubbles in the food matrix.
(C) High concentration of Vitamin C in the liquid.
(D) Large particle sizes or clumps in the liquid.

111. Consider the following statements about ultrasound in food processing:
I. It can be used to tenderize meat by disrupting myofibrillar proteins.
II. Thermosonication refers to combining ultrasound with moderate heat to enhance microbial inactivation.
III. Ultrasound creates localized "hot spots" with extreme temperatures and pressures.
IV. Ultrasound frequencies used in food processing are within human hearing range.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and IV only

112. In PEF processing, the critical parameter that must be exceeded to induce irreversible pore formation in a microbial cell is the:
(A) Isoelectric point of the protein
(B) Latent heat of vaporization
(C) Eutectic threshold
(D) Transmembrane potential

NODIA

113. Which of the following best describes the "acoustic cavitation threshold" in ultrasound processing?
(A) The minimum acoustic pressure needed to produce bubbles in liquids.
(B) The minimum sound frequency that remains audible to the human ear.
(C) The maximum bulk temperature the food reaches before it degrades.
(D) The specific point where all microbial DNA is completely denatured.

114. Which of the following statements regarding the use of PEF for solid foods is incorrect?
(A) PEF can be used as a pre-treatment to enhance the extraction of juice from sugar beets.
(B) PEF improves the cutting properties and reduces oil uptake in potato fries.
(C) PEF is widely used to achieve commercial sterility in solid cuts of meat.
(D) Treatment of solid foods with PEF usually involves placing the food in a conducting liquid medium.

115. In the following question, read the two statements and select the correct option:
Statement I: Sonoporation refers to the use of sound waves to increase the permeability of cell plasma membranes.
Statement II: The extreme localized temperatures generated during ultrasound cavitation cause a significant and uniform rise in the bulk temperature of the food.
(A) Both Statement I and Statement II are

(A) Corona discharge – Most common commercial method for ozone generation
(B) Ozone stability – Highly stable gas, can be stored in cylinders for months
(C) UV light (185 nm) – Can generate small amounts of ozone from air
(D) Aqueous ozone – Used to wash fresh produce and extend shelf life

134. In Ohmic heating, the electrical conductivity of the food material increases as the temperature rises. How does this phenomenon affect the heating rate if a constant voltage is applied?
(A) The heating rate slows down gradually and eventually stops completely.
(B) The heating rate decreases linearly as electrical resistance changes.
(C) The heating rate accelerates, potentially leading to thermal runaway.
(D) The heating rate remains perfectly constant throughout the process.

135. The generation of Reactive Nitrogen Species (RNS) and Reactive Oxygen Species (ROS) in cold plasma technology exerts what direct effect on bacterial cells?
(A) Immediate freezing of intracellular fluids.
(B) Complete extraction of cellular bound water.
(C) Spontaneous mutation into beneficial lactic acid bacteria.
(D) Lipid peroxidation and etching of the cell membrane.

136. Nisin is a natural bacteriocin approved as a food preservative. Which specific group of microorganisms does it primarily inhibit?
(A) Gram-positive bacteria and spore-formers.
(B) Gram-negative pathogens such as E. coli.
(C) Yeasts and molds commonly found in foods.
(D) Enteric viruses that cause food infection.

137. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
Assertion (A): Essential oils from plants, such as thyme and oregano, exhibit broad-spectrum antimicrobial activity.
Reason (R): The active phenolic compounds in essential oils, like thymol and carvacrol, can penetrate microbial cell membranes, disrupting cellular structure and function.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

138. Which of the following is a correct statement regarding the application of nano-emulsions in food preservation?
(A) They are visible to the naked eye as large, highly unstable oil droplets.
(B) They improve the solubility, stability, and delivery of essential oils.
(C) They rely entirely on ionizing radiation to exert antimicrobial effects.
(D) They are strictly prohibited by food safety regulations in all products.

139. Match the plant extracts or natural antimicrobials in List I with their predominant active compounds in List II:
List I: (Natural Antimicrobial)
P. Clove
Q. Garlic
R. Mustard
S. Cinnamon
List II: (Active Compound)
I. Allicin
II. Cinnamaldehyde
III. Eugenol
IV. Allyl isothiocyanate
(A) P-III, Q-I, R-IV, S-II
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-I, S-II
(D) P-III, Q-IV, R-I, S-II

140. Which of the following characteristics does NOT accurately describe bacteriocins?
(A) They are ribosomally synthesized antimicrobial peptides.
(B) They are typically produced by lactic acid bacteria to inhibit closely related species.
(C) They are highly resistant to digestion by human gastrointestinal proteases.
(D) They are generally recognized as safe (GRAS) due to their non-toxicity to humans.

141. Consider the following statements about combination preservation methods (Hurdle Technology):
I. Combining MAP, refrigeration, and natural antimicrobials can drastically extend the shelf life of fresh meat.
II. The goal is to achieve a synergistic effect

Click Here to Buy book on Amazon

(B) P-II, Q-I
(C) P-I, Q-I
(D) P-II, Q-II

125. Which of the following is NOT a property of Ozone (O_3) used in food preservation?
(A) It acts as a highly powerful biological oxidizing agent in water.
(B) It can be widely used for water treatment and surface sanitization.
(C) It decomposes rapidly back into stable and safe diatomic oxygen.
(D) It leaves a toxic chemical residue on food surfaces after use.

126. Consider the following statements about Ohmic heating:
I. It is also known as Joule heating.
II. It is highly dependent on the electrical conductivity of the food.
III. It struggles to heat solid particles and liquids at the same rate.
IV. It does not require heat transfer through a solid-liquid interface (no hot surfaces).
Which of the above statements are correct?
(A) I, II, and III only
(B) I, II, and IV only
(C) II, III, and IV only
(D) I, III, and IV only

127. In the context of microwave heating, the "loss tangent" (dissipation factor) determines:
(A) The depth at which microwave energy is completely reflected.
(B) The ability of food to convert microwave energy into heat.
(C) The total amount of moisture lost during the heating process.
(D) The physical shrinkage rate of packaging during high heating.

128. Which specific wavelength range of UV light (UV-C, peaking around 254 nm) exhibits the highest germicidal effectiveness for treating food contact surfaces and air?
(A) 320 - 400 nm
(B) 280 - 320 nm
(C) 400 - 700 nm
(D) 200 - 280 nm

129. Which of the following statements regarding Non-Thermal Plasma (Cold Plasma) is incorrect?
(A) It causes a dramatic rise in bulk temperature to sterilize food.
(B) It generates Reactive Oxygen and Reactive Nitrogen Species in gas.
(C) It acts only at surfaces, lacking deep penetration capabilities.
(D) It is generated at atmospheric pressure using barrier discharges.

130. In the following question, read the two statements and select the correct option:
Statement I: Radio Frequency (RF) waves have longer wavelengths and deeper penetration depths compared to Microwaves.
Statement II: RF heating is commonly used for post-baking drying and thawing of large frozen meat blocks.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

131. Identify the correctly matched pair regarding novel technologies and their primary antimicrobial mechanism:
(A) Cold Plasma – Oxidative stress on membranes via reactive species
(B) Ohmic heating – Destruction of cellular DNA via rapid heating
(C) Microwave heating – Formation of membrane pores via thermal fields
(D) Ozonation – Application of extreme hydrostatic pressure to cells

132. A processor is using Ohmic heating to pasteurize a soup containing potato cubes in a broth. To achieve uniform heating without overcooking the broth, how should the electrical conductivities of the two components compare?
(A) The potato cubes must have absolutely zero electrical conductivity during heating.
(B) The broth must be infinitely more electrically conductive than the potato cubes.
(C) The potato cubes should be frozen completely solid prior to starting the process.
(D) The conductivities of both components should be as closely matched as possible.

133. Identify the incorrectly matched pair regarding ozone generation and application:

Downloaded from www.pdf.tube

(C) Acting as an antimicrobial agent in wines.
(D) Preventing non-enzymatic browning (Maillard reaction) during dehydration.

66. Consider the following statements comparing hot smoking and cold smoking:
I. Hot smoking simultaneously cooks and flavors the food.
II. Cold smoking is carried out at temperatures generally below 30°C.
III. Cold-smoked products generally require subsequent cooking or refrigeration for safety.
IV. Hot smoking relies exclusively on UV radiation for preservation.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and IV only

67. In winemaking, 'malolactic fermentation' is best defined as:
(A) The bacterial conversion of malic acid to lactic acid, lowering acidity.
(B) The chemical conversion of simple lactose to organic malic acid by wine yeast.
(C) The biological breakdown of ethanol into acetic acid through oxidation paths.
(D) The rapid accumulation of malic acid designed to halt active yeast growth.

68. Which of the following represents the most appropriate answer regarding the application of chemical preservatives?
(A) Preservatives can be used to successfully mask poor sanitation practices in plants.
(B) Preservatives are permitted in all foods at unlimited concentrations under law.
(C) Preservatives completely eliminate the need for thermal processing of liquid foods.
(D) Preservatives must be GRAS and used strictly within specified legal concentrations.

69. Which of the following statements regarding the use of benzoates as food preservatives is incorrect?
(A) Benzoic acid is most effective as an antimicrobial in its undissociated form.
(B) Sodium benzoate is highly effective in low-acid foods (pH > 6.0).
(C) Benzoates are naturally present in some fruits, such as cranberries.
(D) They are primarily used to inhibit yeast and mold growth in fruit juices and beverages.

70. In the following question, read the two statements and select the correct option:
Statement I: Liquid smoke preparations are often preferred over traditional smoking because they eliminate the presence of polycyclic aromatic hydrocarbons (PAHs).
Statement II: Liquid smoke is produced by the condensation of wood smoke followed by fractional distillation.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

71. Identify the correctly matched pair regarding permitted preservatives and their common applications:
(A) Sorbates – Preservation of fresh, untreated raw meats
(B) Sulfur dioxide – Chemical stabilization of sterile UHT milk
(C) Nitrates – Effective prevention of staling in white bread
(D) Propionates – Inhibition of rope and mold in bakery products

NODIA

72. During the natural fermentation of cabbage into sauerkraut, a sequence of microbial succession occurs. If a batch exhibits an uncharacteristic slimy texture and off-flavor, which stage of the process likely failed?
(A) Initial inhibition of aerobic spoilage organisms by salt and anaerobic conditions.
(B) Excessive production of ethanol by wild yeasts introduced during the early stages.
(C) High temperature thermal retorting of cabbage before any fermentation can start.
(D) Direct addition of synthetic acetic acid to halt the fermentation process too soon.

73. Identify the incorrectly matched pair regarding fermentation byproducts:
(A) Homofermentative LAB – Produce primarily lactic acid
(B) Saccharomyces cerevisiae – Produces primarily propionic acid

where the total inhibition is greater than the sum of individual hurdles.
III. It generally results in improved sensory and nutritional quality compared to severe traditional processing.
IV. It is only applicable to liquid foods.
Which of the above statements are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and IV only

142. In nanotechnology applications for food, 'nano-encapsulation' refers to:
(A) Modifying the macroscopic physical packaging structure of a food container.
(B) Altering the genetic code of a plant tissue to produce nanoscale vitamins.
(C) Trapping active bioactives in nanoscale vesicles to protect and release them.
(D) Using engineered nanobots to physically destroy bacterial cells in foods.

143. Which of the following nanomaterials is most extensively researched and utilized in active food packaging for its strong antimicrobial properties?
(A) Gold nanoparticles
(B) Silver nanoparticles
(C) Silicon dioxide nanoparticles
(D) Titanium carbide nanoparticles

144. Which of the following statements regarding Natamycin is incorrect?
(A) It is naturally produced by the bacterium Streptomyces natalensis.
(B) It is a highly effective agent against common yeasts and molds.
(C) It is frequently used as a surface treatment for cheeses and sausages.
(D) It is a broad-spectrum antibiotic effective against gram-negative cells.

145. In the following question, read the two statements and select the correct option:
Statement I: Chitosan is a natural biopolymer derived from the deacetylation of chitin, found in crustacean shells.
Statement II: Chitosan exhibits strong antimicrobial and film-forming properties, making it useful for edible food coatings.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

146. Identify the correctly matched pair regarding natural antimicrobials:
(A) Pimaricin – Highly active compound extracted directly from thyme leaves
(B) Lactoferrin – A common plant-derived phenolic compound used in salads
(C) Lysozyme – Egg-white enzyme that degrades bacterial cell walls
(D) Phytoalexins – Antimicrobial proteins isolated from fresh bovine milk

147. A food technologist designs a shelf-stable intermediate-moisture fruit snack. They use mild drying to achieve an a_w of 0.88, lower the pH to 4.2 using citric acid, and add potassium sorbate. This specific approach of designing food stability is an applied example of:
(A) Hurdle technology
(B) Radappertization
(C) Cryogenic preservation
(D) High pressure sterilization

148. Identify the incorrectly matched pair regarding food preservation concepts:
(A) Synergism – Hurdles working together to produce a greater combined effect.
(B) Homeostasis – Tendency of a microorganism to maintain its internal state.
(C) Clean label – Consumer preference for natural over synthetic additives.
(D) MIC – Highest concentration of an antimicrobial that stimulates growth.

149. In evaluating the efficacy of a new plant extract for food preservation, scientists determine its MIC (Minimum Inhibitory Concentration). What does this value represent?
(A) The exact dose required to instantly kill the entire bacterial population.
(B) The lowest concentration of the agent that prevents visible growth.
(C) The concentration that makes the food product sensory unacceptable.
(D) The maximum legal limit of the extract permitted by food authorities.

Click Here to Buy book on Amazon

9. (B) Freezing completely and irreversibly destroys all inherent food enzymes.
Enzymes catalyze various biochemically destructive reactions in food materials, but sub-freezing temperatures do not permanently denature them. Freezing merely slows down enzymatic reaction rates by reducing molecular mobility and liquid water availability. Once the food is thawed, these active enzymes resume their catalytic functions, necessitating heat treatments like blanching prior to freezing to ensure long-term stability.

10. (A) Both Statement I and Statement II are correct.
Hurdle technology employs synergistic combinations of multiple preservation factors, which allows each individual parameter to be applied at a lower intensity. This multi-target approach disrupts the homeostatic equilibrium of target microorganisms through various pathways. The metabolic energy required to maintain internal homeostasis under these multiple sub-lethal stresses leads to metabolic exhaustion and microbial death.

11. (A) Z-value – Temperature increase needed to reduce D-value tenfold
Thermal death kinetics describe the inactivation of microorganisms under thermal stress. The parameter representing the temperature change required to produce a tenfold, or one-log, modification in the decimal reduction time is defined as the thermal resistance constant. This constant reflects the temperature sensitivity of a specific microorganism, with larger values indicating lower sensitivity to temperature changes.

12. (C) Inadequate blanching time prior to freezing.
Raw vegetables contain endogenous enzymes like lipoxygenase, peroxidase, and catalase that remain biochemically active even at standard frozen storage temperatures. If the initial blanching treatment is brief or skipped, these active enzymes catalyze lipid oxidation and structural cross-linking over time. This enzymatic activity directly results in the development of off-flavors, rancidity, and tough, fibrous textures in stored products.

13. (D) Staphylococcus aureus – Highly heat-resistant spore former
Staphylococcus aureus is a facultative anaerobic, Gram-positive coccus that exists solely in a vegetative state and does not form protective endospores. While the enterotoxins it produces during growth are highly heat-stable, the bacterial cells themselves are easily destroyed by standard pasteurization temperatures. It should not be classified among highly heat-resistant, spore-forming microorganisms.

14. (C) It minimizes nutritional loss while achieving equivalent lethality.
High-temperature short-time pasteurization utilizes continuous flow plate heat exchangers to process milk efficiently. Because the thermal destruction of microorganisms has a higher temperature dependence than the degradation of chemical nutrients and sensory compounds, this rapid heating method achieves equivalent microbial destruction while minimizing the loss of heat-sensitive vitamins, denaturation of whey proteins, and development of cooked flavors.

15. (B) The destruction rate increases, leading to a shorter D-value.
Thermal inactivation of microorganisms follows first-order reaction kinetics, meaning the rate of destruction is proportional to the viable population. Elevating the processing temperature increases the kinetic energy of molecules, which accelerates the denaturation of vital cellular proteins and nucleic acids. Consequently, the rate of microbial death rises, resulting in a significantly shorter decimal reduction time.

16. (D) Nicolas Appert
The preservation method of sealing food in airtight glass jars and heating them in boiling water was invented in the early nineteenth century. This foundational technique of thermal food preservation was developed by a French confectioner and chef, who succeeded in preventing spoilage for military provisions. The process later evolved into commercial tin canning and modern retorting systems.

17. (A) Both A and R are true and R is the correct explanation of A.
Low-acid canned foods must undergo thermal processing under pressure within hermetically sealed retorts. At standard atmospheric pressure, boiling water cannot exceed one hundred degrees

NODIA

ANSWERS

1. (A) It renders free water unavailable for microbial growth.
Water activity represents the energy state of water in a system. Lowering water activity decreases the amount of free, unbound water available for chemical reactions and microbial proliferation. Without sufficient free water, metabolic activities of spoilage bacteria, yeasts, and molds are severely restricted, which effectively halts cell division and extends the storage shelf life of food products.

2. (C) A is true but R is false.
Hurdle technology utilizes combinations of mild preservation parameters to ensure microbial safety and maintain food quality. While these combined hurdles synergistically prevent microbial survival, microorganisms can often overcome single mild preservation factors when those factors are applied in isolation. Therefore, individual mild hurdles are rarely sufficient on their own to guarantee complete microbial stability in food products.

3. (A) Blanching inactivates spoilage enzymes before freezing.
Blanching is a mild thermal pretreatment primarily applied to vegetables before freezing, drying, or canning. This process rapidly inactivates quality-degrading enzymes, such as catalase and peroxidase, which would otherwise cause undesirable changes in color, flavor, and texture during frozen storage. It also expels intercellular gases and reduces the initial microbial load on the vegetable surfaces.

4. (A) P-III, Q-I, R-II, S-IV
Thermal preservation methods utilize specific time and temperature combinations to achieve targeted levels of microbial destruction. Low-temperature long-time pasteurization operates at sixty-three degrees Celsius for thirty minutes, while high-temperature short-time pasteurization uses seventy-two degrees Celsius for fifteen seconds. Ultra-high temperature processing requires extreme heat for seconds, and commercial sterilization requires retorted heat to eliminate highly resistant spores.

5. (B) Lactobacillus bulgaricus
Commercial sterility of low-acid canned foods targets highly heat-resistant, spore-forming anaerobic pathogens, primarily Clostridium botulinum. Other highly resistant spore-formers like Geobacillus stearothermophilus and Clostridium sporogenes serve as surrogates to evaluate sterilizing efficiency. Non-spore-forming vegetative bacteria, such as lactic acid bacteria used in yogurt fermentation, possess low thermal resistance and are easily destroyed during initial mild thermal processing.

6. (B) I and IV only
Ultra-high temperature processing operates between one hundred thirty-five and one hundred fifty degrees Celsius for a few seconds to destroy all vegetative cells and spores. Because the food becomes sterile, aseptic packaging under sterile conditions is mandatory to prevent recontamination. These shelf-stable products do not require cold chain maintenance during storage and can undergo minor Maillard browning reactions.

7. (D) The heating time required to reduce the microbial count by 90%.
The decimal reduction time, or decimal decay value, measures the thermal resistance of a specific microorganism at a constant temperature. It represents the heating time, in minutes, required to reduce the viable microbial population by ninety percent, which corresponds to a one-logarithmic cycle reduction. A larger value indicates greater thermal resistance of the targeted microorganism.

8. (A) II, III, I, IV
Bacterial endospores possess the highest thermal resistance among food microorganisms, with thermophilic spores of Geobacillus stearothermophilus being more heat-resistant than mesophilic spores of Clostridium botulinum. Vegetative cells, such as Salmonella species, exhibit significantly lower thermal tolerance than bacterial spores. Yeasts and molds are generally highly sensitive to heat and are easily inactivated during basic thermal processes.

Downloaded from www.pdf.tube

below zero point eight five. This threshold is essential for intermediate-moisture food safety.

45. (D) Case hardening
During rapid hot air drying, if the rate of surface evaporation exceeds the rate of internal moisture diffusion, the outer layers of the food piece dry out prematurely. This rapid drying causes soluble solids to migrate to the surface, where they form a hard, impermeable skin. This physical barrier, known as case hardening, traps moisture inside.

46. (C) Disperse the liquid feed into fine droplets to increase surface area.
The atomizer is the core component of a spray drying system, designed to break up bulk liquid feed into a fine mist of microscopic droplets. By dispersing the liquid feed, the atomizer exponentially increases the surface-area-to-volume ratio of the product. This massive surface area enables near-instantaneous water evaporation upon contact with the hot air stream inside.

47. (A) Both A and R are true and R is the correct explanation of A.
Freeze drying produces dehydrated products of superior physical and structural quality with minimal shrinkage. This preservation occurs because the water within the frozen food matrix is directly converted from solid ice into water vapor through sublimation, completely bypassing the liquid phase. Removing water without liquid phase migration prevents capillary collapse and structural deformation of the food tissue.

48. (D) It removes water by immersing the food product in a hypertonic solution.
Osmotic dehydration is a partial water removal process achieved by placing whole or sliced food pieces into a concentrated hypertonic solution, typically sugar or salt. The difference in chemical potential between the dilute cell sap and the surrounding concentrated solution drives water out of the plant tissues across semipermeable cell membranes, while solutes simultaneously migrate inward.

49. (A) P-II, Q-I, R-III, S-IV
Industrial drying technologies are selected based on the physical state and heat sensitivity of the raw food material. Spray drying converts liquid feeds into fine powders, whereas freeze drying sublimates ice from highly temperature-sensitive materials. Drum dryers dry viscous slurries into flakes on rotating heated cylinders, and cabinet dryers process solid food pieces in batch operations.

50. (C) Direct destruction of microbial spores through thermal stress.
Salting preserves food by establishing high osmotic pressure, which draws water out of microbial cells through plasmolysis and lowers the overall water activity of the food matrix. High concentrations of chloride ions also inhibit vital microbial enzyme systems. However, salting does not exert any thermal stress and is incapable of directly destroying dormant, heat-resistant bacterial endospores.

51. (A) I, II, and III only
Sodium nitrite is a critical ingredient in meat curing that inhibits the germination of Clostridium botulinum spores and produces the characteristic pink nitrosylhemochrome pigment. However, high-heat cooking can cause nitrites to react with secondary amines, forming carcinogenic nitrosamines. Sugar is added to modify flavor and support beneficial lactic fermentation, not primarily to reduce water activity.

52. (D) The unique condition where water coexists as solid, liquid, and gas.
In freeze drying, sublimation requires operating the system below the triple point of water. This specific thermodynamic state represents the temperature of zero point zero one degrees Celsius and pressure of six hundred eleven Pascals, where solid ice, liquid water, and water vapor coexist in equilibrium. Operating below these limits ensures that ice converts directly to vapor.

53. (B) II, I, III
The freeze drying process begins by freezing the food material to crystallize all free water, establishing a rigid solid matrix. Next, primary drying occurs under vacuum, where ice is removed through sublimation. Finally, secondary drying is conducted at slightly elevated temperatures to remove bound water through desorption, reducing the final moisture content to a stable level.

54. (C) High molecular weight polymers penetrate food tissue faster than low molecular weight sugars.
During osmotic dehydration, mass transfer rates depend heavily on the molecular size of the osmotic agent. Low-molecular-weight solutes,

NODIA

Celsius, which is insufficient to destroy highly heat-resistant bacterial endospores of Clostridium botulinum in a reasonable time. Increasing the chamber pressure elevates the boiling point, enabling processing temperatures of one hundred twenty-one degrees.

18. (C) It blocks the entry of microorganisms, gases, and moisture.
Hermetic sealing refers to the creation of a completely airtight closure on a food container. This physical barrier prevents the transmission of gases, ambient moisture, and particulate contaminants into the package. By blocking the entry of external spoilage microorganisms and atmospheric oxygen, hermetic seals maintain internal sterility and protect processed food products from oxidation and post-process contamination.

19. (A) P-II, Q-IV, R-III, S-I
Canning defects arise from chemical or microbiological activities inside sealed containers. Chemical reactions between acid foods and the steel can produce hydrogen gas, causing hydrogen swells. Physical vacuum loss causes flippers to bulge when struck. Microbially, Geobacillus stearothermophilus causes flat sour spoilage without gas production, whereas Desulfotomaculum nigrificans produces hydrogen sulfide, creating sulfide stinker spoilage with black discoloration.

20. (D) Completely halting all chemical oxidation reactions.
Refrigeration preserves food by lowering the storage temperature, which slows the kinetic energy of molecules and reduces biological reaction rates. This cooling retards the growth of mesophilic pathogens, slows enzymatic degradation, and decreases the respiration rates of fresh produce. However, chemical reactions like lipid oxidation and non-enzymatic browning continue to occur slowly and are not completely halted.

21. (A) I, II, and III only
Chilling injury is a physiological disorder that affects susceptible tropical and subtropical crops when they are stored at low temperatures above their freezing points. Common symptoms include surface pitting, water-soaked tissues, internal browning, and failure to ripen normally. This damage is caused by membrane lipid phase transitions and metabolic imbalances, not by physical ice crystal formation.

22. (C) The inactivation of public health pathogens and organisms capable of growing under normal storage.
Commercial sterility describes a condition achieved through thermal processing where all pathogenic microorganisms and spoilage-causing organisms capable of reproducing under normal, non-refrigerated storage conditions are destroyed. Extremely heat-resistant thermophilic spores may survive this treatment, but they remain dormant and cannot germinate or grow if the food is stored at temperatures below forty-five degrees Celsius.

23. (B) III, I, II, IV
The commercial canning sequence begins with filling the prepared food into containers, followed by sealing them. Prior to final sealing, exhausting is performed to expel entrapped air and oxygen, creating a vacuum. The sealed containers then undergo thermal processing inside a retort to achieve commercial sterility, followed by rapid cooling to halt the cooking process and prevent thermophilic germination.

24. (A) They require longer thermal processing times than metal cans of similar volume.
Retort pouches are flexible, thin laminate packages characterized by a high surface-area-to-volume ratio. This physical design allows for rapid heat penetration to the thermal center of the food during processing. Consequently, they require significantly shorter thermal processing times than traditional cylindrical metal cans of equivalent volume, which helps to preserve nutritional quality and minimize sensory degradation.

25. (A) Both Statement I and Statement II are correct.
Low-acid foods require severe thermal processing because they support the germination and growth of Clostridium botulinum spores, which produce deadly neurotoxins. In high-acid foods with a pH below four point six, these highly heat-resistant spores are physiologically inhibited and cannot germinate or grow. Consequently, acidic foods can be safely preserved using milder thermal treatments like simple pasteurization.

Click Here to Buy book on Amazon

150. The antimicrobial action of phenolic compounds from plant extracts primarily results in which of the following physiological effects on bacteria?

(A) Complete inhibition of viral reverse transcriptase during early cell entry.

(B) Cellular hyper-hydration and swelling of the cytoplasm leading to rupture.

(C) Disruption of the cell membrane, causing leakage of internal components.

(D) Instantaneous petrification and hardening of the outer cell wall structure.

www.nodia.in

NODIA

spends in the critical zone of maximum ice crystal formation. Spending less time in this temperature range promotes the development of small, uniform ice crystals and prevents solute migration. Slow freezing, conversely, prolongs exposure to this zone, leading to damagingly large crystal growth.

36. (B) I, II, and IV only
Sun drying is a low-cost, traditional dehydration method that relies entirely on solar radiation and ambient weather, which exposes food to dust and insect contamination. In contrast, mechanical hot air dryers require higher capital investment but provide precise control over temperature and relative humidity. This controlled environment ensures faster drying rates and a highly uniform final moisture content.

37. (B) The temperature below which no liquid solution remains in the food matrix.
During the freezing of a food system, ice crystals continually form, which progressively concentrates the remaining unfrozen solution of dissolved solutes. As the temperature is lowered further, a specific threshold is reached where the solute and water crystallize simultaneously as a solid mixture. This temperature represents the point below which no liquid phase remains.

38. (A) II, III, I
The hot air drying process of solid food starts with an initial warming-up period, where the food absorbs sensible heat to match the drying conditions. Once the surface temperature equals the wet-bulb temperature, the constant-rate drying period begins, characterized by the rapid evaporation of free surface water. Finally, the falling-rate period occurs when internal moisture diffusion limits evaporation.

39. (D) The drying rate is constant throughout the entire drying process.
During hot air drying, the rate of moisture removal does not remain constant. While an initial constant-rate period occurs when free water evaporates rapidly from the food surface, the majority of the drying process for solid foods takes place during the falling-rate period. In this phase, the drying rate continuously declines as internal water diffusion limits migration.

40. (A) Both Statement I and Statement II are correct.
The glass transition temperature is a critical thermodynamic parameter for predicting the physical stability of dehydrated foods. Below this temperature, amorphous food matrices exist in a highly stable, glassy state with low molecular mobility. Storing foods above this threshold causes a transition to a rubbery state, which dramatically increases molecular mobility and promotes caking and staling.

41. (B) Desorption isotherm – Represents moisture loss from food to the air
Sorption isotherms describe the relationship between moisture content and water activity in food at a constant temperature. Specifically, a desorption isotherm illustrates the path of moisture loss as a food product dries and releases water to the surrounding air. In contrast, bound water is difficult to remove, and sublimation refers to solid-to-gas phase transitions.

NODIA

42. (B) An upward cold air current that suspends and freezes the peas simultaneously.
Fluidized bed freezers utilize high-velocity cold air directed vertically upward through a mesh conveyor belt carrying particulate food items. When the upward aerodynamic force of the air matches the gravitational force of the particles, the individual food items become suspended in the air stream. This fluid-like state ensures rapid, uniform heat transfer and prevents clumping during freezing.

43. (A) Recrystallization – Improves texture of frozen foods during storage
Recrystallization is a physical phenomenon that occurs in frozen foods during storage, particularly when temperatures fluctuate. It involves changes in the size, shape, and orientation of ice crystals, where smaller crystals melt and merge into larger, more irregular ones. This crystal growth damages cell walls and leads to a grainy, degraded texture rather than improving food quality.

44. (C) 0.85
Water activity is a critical intrinsic factor controlling microbial growth. While most common spoilage bacteria require high moisture levels to multiply, nearly all pathogenic foodborne bacteria, including Staphylococcus aureus under aerobic conditions, are completely inhibited when the water activity of a food product is reduced

and carbon dioxide. This process significantly decreases the sugar content and increases the alcohol concentration, which helps preserve the beverage against common bacterial spoilage.

64. (A) P-II, Q-I, R-IV, S-III
Fermented foods are produced through the metabolic activity of specific starter cultures. Yogurt is fermented by a synergistic symbiosis of Lactobacillus bulgaricus and Streptococcus thermophilus, while wine requires yeast-driven alcoholic fermentation. Vinegar production relies on Acetobacter aceti to oxidize ethanol into acetic acid, and sauerkraut is fermented by a sequence of lactic acid bacteria.

65. (A) Serving as a primary leavening agent in baked goods.
Sulfur dioxide is a versatile additive used in food preservation for its antioxidant and antimicrobial properties. It effectively inhibits enzymatic browning in fresh fruits, controls wild yeasts and spoilage bacteria in winemaking, and prevents non-enzymatic Maillard browning in dehydrated products. However, it does not possess gas-generating properties and is not used as a baking leavening agent.

66. (A) I, II, and III only
Hot smoking processes foods at high temperatures to cook and flavor the product simultaneously, while cold smoking is performed below thirty degrees Celsius to deposit smoke compounds without coagulating proteins. Because cold-smoked items do not undergo thermal cooking, they remain microbiologically raw and require refrigeration, cooking, or curing to ensure safety during subsequent storage.

67. (A) The bacterial conversion of malic acid to lactic acid, lowering acidity.
Malolactic fermentation is a secondary biochemical process in winemaking conducted by lactic acid bacteria, primarily Oenococcus oeni. This pathway converts sharp, dicarboxylic malic acid into milder, monocaboxylic lactic acid and carbon dioxide. This biological conversion reduces the overall acidity of the wine, mellowing its flavor profile and improving microbiological stability before bottling.

68. (D) Preservatives must be GRAS and used strictly within specified legal concentrations.
Chemical food preservatives must be officially classified as generally recognized as safe and utilized strictly within maximum regulatory limits. They cannot be used to conceal poor manufacturing practices or raw material spoilage. Instead, these additives are applied as targeted hurdles to extend shelf life and control specific pathogens in combination with sanitation and thermal processes.

69. (B) Sodium benzoate is highly effective in low-acid foods (pH $>$ 6.0).
Benzoates act as effective antimicrobial preservatives primarily in their undissociated benzoic acid form, which can readily cross microbial cell membranes. Because the dissociation of benzoic acid is pH-dependent, it is highly active in acidic conditions below pH four point zero. In low-acid foods with a pH above six, it dissociated completely and becomes ineffective.

70. (A) Both Statement I and Statement II are correct.
Liquid smoke preparations are widely used because they eliminate carcinogenic polycyclic aromatic hydrocarbons present in natural wood smoke. This commercial ingredient is produced by burning wood under controlled pyrolysis conditions, condensing the resulting vapor in water, and applying fractional distillation and filtration. This processing removes insoluble tar and hazardous compounds, yielding a safer flavoring agent.

71. (D) Propionates – Inhibition of rope and mold in bakery products
Sorbates, sulfur dioxide, and nitrites have specific regulatory applications. Propionic acid and its calcium or sodium salts are highly effective antimicrobials used in bakery manufacturing. They specifically target and inhibit the growth of mold and rope-forming Bacillus mesentericus bacteria in bread. This preservation prevents spoilage without interfering with the fermentation activity of baking yeasts.

72. (A) Initial inhibition of aerobic spoilage organisms by salt and anaerobic conditions.
Sauerkraut fermentation relies on adding salt to draw out water and create an anaerobic environment, which suppresses aerobic spoilage microorganisms. This allows a natural sequence

Downloaded from www.pdf.tube

such as sodium chloride and simple sugars, possess high diffusion coefficients and readily penetrate cellular structures. Conversely, high-molecular-weight polymers are physically too large to diffuse quickly across cell membranes and primarily act by withdrawing water from the tissues.

55. (C) Statement I is correct but Statement II is incorrect.
In meat curing, adding reducing agents like ascorbic acid or erythorbate accelerates the chemical reduction of nitrite to nitric oxide, which speeds up color development. Furthermore, these antioxidants scavenge reactive nitrosating species under acidic conditions, which actually inhibits the formation of carcinogenic nitrosamines during high-temperature cooking of cured meats rather than promoting their synthesis.

56. (A) Sodium nitrite – Acts as a powerful antimicrobial agent
Meat curing ingredients serve specific biochemical roles during processing. Sodium nitrite acts as a powerful antimicrobial agent that specifically prevents the outgrowth of anaerobic Clostridium botulinum spores. In contrast, sodium chloride primarily lowers water activity and solubilizes myofibrillar proteins, while phosphates increase water holding capacity, and sucrose provides flavor and balances saltiness.

57. (B) Decreasing the relative humidity of the exhaust air by adjusting drying temperatures.
Powder stickiness and wall chamber deposition in spray dryers occur when the product surface transition temperature falls below its glass transition temperature. This condition is driven by high relative humidity in the exhaust air, which leaves excess moisture on the powder. Adjusting operating parameters to decrease exhaust air relative humidity effectively reduces stickiness and ensures smooth powder recovery.

58. (B) Hot air drying – Driven by thermal radiation only
Hot air drying is a convective preservation process, not a radiative one. In this operation, hot air passes over the food, transferring sensible heat through convection to evaporate moisture from the surface. The moisture migration from the interior of the food to the outer boundary is driven by internal concentration, capillary forces, and partial vapor pressure gradients.

59. (A) Water moves out of the strawberry, and sugar moves into the strawberry.
Immersing strawberries in a highly concentrated sucrose solution initiates simultaneous countercurrent mass transfer. Due to osmotic pressure gradients across the semipermeable cell membranes of the fruit, water flows out of the strawberry tissue into the surrounding solution. Concurrently, sucrose molecules diffuse from the concentrated solution into the intercellular spaces of the fruit tissue.

60. (C) High-temperature frying
Nitrosamines are carcinogenic compounds formed when residual nitrites react with secondary amines in cured meats under acidic conditions. This chemical reaction is strongly temperature-dependent and is accelerated by high-heat environments. Consequently, high-temperature pan frying of bacon or cured sausages provides the thermal energy required to synthesize these hazardous compounds compared to boiling or steaming.

61. (D) Phenolics
Wood smoke contains a complex mixture of vaporized chemical compounds generated during the thermal degradation of wood components. The phenolic fraction, produced primarily from the pyrolysis of lignin, is responsible for the antimicrobial and antioxidant properties of smoke. These compounds inhibit microbial growth on food surfaces and retard lipid oxidation during the smoking process.

62. (A) Both A and R are true and R is the correct explanation of A.
Lactic acid fermentation is a highly effective, traditional preservation method for vegetables such as cabbage. During this anaerobic process, beneficial lactic acid bacteria metabolize sugars into organic acids, primarily lactic acid. This acid accumulation rapidly lowers the pH of the food system, creating an acidic environment that inhibits the growth of pathogens and spoilage microorganisms.

63. (B) Yeasts convert sugars into ethanol and carbon dioxide anaerobically.
Alcoholic fermentation is a metabolic process primarily conducted by yeasts, such as Saccharomyces cerevisiae, under anaerobic conditions. During this pathway, yeasts convert simple sugars like glucose and fructose into ethanol

NODIA

26. (B) Psychrotrophs – Organisms that grow well at refrigeration temperatures
Psychrotrophs are cold-tolerant microorganisms that possess optimum growth temperatures between twenty and thirty degrees Celsius but can actively multiply at refrigeration temperatures near zero to seven degrees. These organisms, including specific strains of Pseudomonas, Listeria, and molds, are the primary agents responsible for the biochemical spoilage of perishable foods held in cold storage systems.

27. (A) Putrefactive anaerobic spoilage due to under-processing.
Severe swelling at both ends of a canned food container coupled with a putrid odor indicates the growth of gas-producing anaerobic bacteria, such as Clostridium sporogenes. This spoilage typically results from under-processing during retorting, which fails to destroy highly resistant bacterial spores, or from post-processing leakage that introduces environmental contaminants into the can.

28. (C) Refrigeration – Above 15°C
Refrigeration of perishable foods requires maintaining cold storage temperatures generally between zero and eight degrees Celsius, which is significantly below fifteen degrees. Storing food above fifteen degrees Celsius falls into the danger zone, which accelerates chemical degradation and permits the rapid multiplication of mesophilic foodborne pathogens and spoilage microorganisms.

29. (D) 121.1°C with a Z-value of 10°C
The sterilizing value of a thermal process represents its equivalent lethality relative to a standardized reference temperature. For low-acid canned foods, this integrated thermal lethality is calculated referencing a temperature of one hundred twenty-one point one degrees Celsius and assuming a thermal resistance constant of ten degrees Celsius, which corresponds to the heat resistance of Clostridium botulinum.

30. (C) Irreversible muscle contraction in fibers known as cold shortening.
Rapidly cooling meat carcasses to temperatures below fifteen degrees Celsius before the onset of rigor mortis triggers the release of calcium ions from the sarcoplasmic reticulum. Because cellular adenosine triphosphate is still present, this sudden calcium surge induces severe and irreversible muscle fiber contraction. This physiological phenomenon, termed cold shortening, causes the meat to become highly tough.

31. (B) The high concentration of dissolved solutes in the food matrix.
Pure water freezes at zero degrees Celsius under standard atmospheric pressure. Food systems, however, are complex mixtures containing dissolved low-molecular-weight solutes such as sugars, mineral salts, and organic acids. These solutes interfere with the formation of organized ice crystal lattices, which depresses the initial freezing point of the food system below that of pure water.

32. (A) Both A and R are true and R is the correct explanation of A.
Individual Quick Freezing rapidly lowers the temperature of food items, moving them quickly through the zone of maximum ice crystal formation. This rapid freezing rate promotes the nucleation of numerous, small ice crystals within intracellular spaces. Consequently, cell membranes remain intact, which minimizes structural damage and reduces drip loss during thawing, preserving the original food texture.

33. (A) It is a surface defect from ice sublimation due to moisture loss.
Freezer burn is a quality defect that occurs when the surface of frozen food undergoes dehydration and oxidation during storage. It is caused by the sublimation of ice crystals directly into water vapor, leaving microscopic cavities in the food tissue. This localized moisture loss produces dry, spongy, discolored patches and accelerates lipid oxidation, degrading overall quality.

34. (A) P-III, Q-I, R-II, S-IV
Commercial freezing methods utilize distinct cooling media and heat transfer mechanisms to reduce food temperatures. Cryogenic systems spray liquid nitrogen or carbon dioxide directly onto food, while air-blast tunnels circulate high-velocity cold air. Plate freezing involves direct contact with hollow refrigerated metal surfaces, and immersion systems freeze products rapidly by dipping them into chilled aqueous brine solutions.

35. (A) Extended time in the zone of maximum ice crystal formation.
Fast freezing is characterized by a rapid reduction in temperature, which minimizes the time food

Click Here to Buy book on Amazon

of lactic acid bacteria, starting with Leuconostoc mesenteroides, to produce acid and carbon dioxide. Failing to establish early anaerobic conditions allows pectinolytic molds and yeasts to multiply, causing slimy textures.

73. (B) Saccharomyces cerevisiae – Produces primarily propionic acid
Microorganisms generate specific primary metabolites during fermentation processes. Saccharomyces cerevisiae is a yeast that converts simple sugars into ethanol and carbon dioxide under anaerobic conditions during alcoholic fermentation. It does not produce propionic acid, which is synthesized by Propionibacterium species used in Swiss cheese manufacture to develop characteristic eyes and flavor.

74. (B) It coagulates meat proteins, aiding drying and restricting pathogen growth.
During the fermentation of dry sausages, lactic acid bacteria ferment added sugars, rapidly reducing the pH below five point three. This acidification approaches the isoelectric point of meat proteins, inducing coagulation and reducing water holding capacity. This physical change facilitates rapid water loss during drying, lowering water activity and restricting the growth of foodborne pathogens.

75. (A) It cleaves and inactivates Vitamin B1 (Thiamine).
Although sulfur dioxide is a highly effective preservative, it causes significant nutritional degradation in specific food products. It chemically cleaves the methylene bridge of thiamine, completely inactivating vitamin B1. For this reason, the use of sulfur dioxide is strictly prohibited in foods that serve as primary dietary sources of thiamine, such as fresh meats.

76. (C) pH 2.5 - 4.0
Benzoic acid functions as an antimicrobial preservative primarily in its undissociated state, which can diffuse across microbial cell membranes to disrupt internal pH homeostasis. The acid possesses a pKa of four point two, meaning it exists mostly in the active, undissociated form in highly acidic environments, making its optimum effective range between pH two point five and four.

77. (A) Both A and R are true and R is the correct explanation of A.
Sorbic acid and its potassium or sodium salts are widely used as effective fungistatic agents in cheeses, bakery products, and beverages. Sorbates inhibit the cellular metabolism of molds and yeasts by blocking specific enzymes, but they exert minimal inhibitory effects on beneficial lactic acid bacteria at standard usage levels. This selectivity allows successful mold control without disrupting fermentation.

78. (C) It requires displaying the “Radura” symbol on food packaging.
Food irradiation is a cold preservation method that exposes food to regulated doses of ionizing radiation to control pathogens, eliminate pests, and inhibit sprouting. This process does not make the food radioactive. To ensure consumer transparency, international food regulations require that all irradiated products carry the distinctive green flower logo, known as the Radura symbol, on their labels.

NODIA

79. (A) P-III, Q-II, R-I
Food irradiation treatments are classified into distinct dosage levels based on the targeted microbial reduction. Radurization applies low doses of ionizing radiation to extend shelf life by reducing spoilage organisms. Radicidization utilizes medium doses to eliminate specific non-spore-forming pathogens like Salmonella. Radappertization requires high doses to achieve commercial sterility, inactivating highly resistant bacterial spores.

80. (D) Carbon-14
Commercial food irradiation utilizes high-energy ionizing radiation sources that are carefully regulated to prevent inducing radioactivity in food. Permitted sources include gamma-ray emitting radionuclides, specifically Cobalt-60 and Cesium-137, as well as machine-generated high-energy electron beams and X-rays. Carbon-14 is a low-energy beta emitter used for radiocarbon dating and is not used for food processing.

81. (B) I, III, and IV only
Gamma rays emitted by radioactive isotopes have high penetration depths, making them suitable for treating large, bulk-packaged foods, whereas machine-generated electron beams have limited penetration. Unlike isotopic sources, electron accelerators run on electricity and can be turned

induced denaturation. Achieving commercial sterility requires combining high pressure with elevated temperatures, a process called pressure-assisted thermal sterilization. This thermal energy destabilizes the spore coat, enabling pressure to inactivate the core.

101. (B) OTR – Oxygen Transmission Rate
In modified atmosphere packaging, film barrier properties are critical parameters. The term representing the rate at which oxygen gas permeates through a polymer film under specific temperature and humidity conditions is defined as the oxygen transmission rate. Selecting a film with an appropriate transmission rate is essential to maintain the target gas composition inside the package.

102. (C) O2 preserves the red color, while CO_2 inhibits aerobic spoilage bacteria.
Fresh red meats packaged in modified atmospheres utilize specific gas mixtures. High concentrations of oxygen promote the formation of oxymyoglobin, which maintains the bright cherry-red color preferred by consumers. Simultaneously, carbon dioxide is included at twenty percent to dissolve into the aqueous phase of the meat, where it acts as an effective bacteriostatic agent against aerobic spoilage bacteria.

103. (D) Adiabatic cooling – The temperature of food significantly drops during the compression phase
During High Pressure Processing, physical compression of the food product and water causes their temperatures to rise, not drop. This phenomenon is known as adiabatic heating, where the temperature increases by approximately three degrees Celsius for every one hundred megapascals of applied pressure. Conversely, pressure release during decompression causes adiabatic cooling back to the initial temperature.

104. (A) 38°C
Physical compression of water-rich foods during High Pressure Processing causes an adiabatic temperature rise of approximately three degrees Celsius per one hundred megapascals. For a process operating at six hundred megapascals, the total adiabatic temperature increase is eighteen degrees Celsius. Adding this increase to the initial food temperature of twenty degrees Celsius yields a maximum temperature of thirty-eight degrees.

105. (B) Package collapse and increased drip loss due to dissolved CO_2 gas.
Carbon dioxide is highly soluble in the aqueous and lipid phases of fresh fish tissues. When fish is packaged with high headspace concentrations of carbon dioxide, the gas rapidly dissolves into the product. This dissolution creates a partial vacuum that can cause package collapse, and it lowers the pH of the tissue, reducing protein water-binding capacity and increasing drip loss.

106. (B) Electroporation, forming pores in cell membranes.
Pulsed Electric Field technology applies short, high-voltage pulses to liquid foods placed between two electrodes. This electrical treatment induces a transmembrane potential across the microbial cell membranes. When this induced potential exceeds a critical threshold, it causes structural instability and leads to the formation of temporary or permanent microscopic pores, a physical phenomenon known as electroporation.

107. (A) Both A and R are true and R is the correct explanation of A.
Ultrasound processing significantly enhances mass transfer operations in food dehydration and extraction. This enhancement is driven by acoustic cavitation, which creates microbubbles that grow and violently implode. The resulting shockwaves and micro-jets generate localized turbulent flow and micro-channels in the food tissue. This structural disruption, often termed the sponge effect, facilitates rapid water and solute diffusion.

108. (C) It is highly effective for pumpable liquids like fruit juices.
Pulsed Electric Field processing is a non-thermal preservation technology primarily designed for pumpable liquid foods, such as fruit juices and dairy products. It is highly effective because liquids can flow continuously through a small electrode gap, ensuring uniform exposure to the electrical pulses. This treatment inactivates vegetative spoilage cells while preserving the fresh taste and heat-sensitive nutrients.

109. (B) P-II, Q-I
Ultrasound applications in food processing are divided based on frequency and intensity. Power ultrasound operates at low frequencies and high intensities, generating acoustic cavitation to disrupt cells, homogenize emulsions, and assist

Downloaded from www.pdf.tube

nitrogen. Carbon dioxide acts as the primary antimicrobial agent, oxygen maintains fresh meat color or prevents anaerobic pathogens, and inert nitrogen acts as a filler gas to prevent package collapse.

92. (A) Both A and R are true and R is the correct explanation of A.
High Pressure Processing is classified as a non-thermal preservation method because it inactivates microorganisms without using high temperatures. HPP utilizes extreme isostatic pressure to disrupt non-covalent bonds, which denatures microbial proteins and destabilizes cell membranes. Because covalent bonds are unaffected, the bulk temperature of the food does not rise significantly, which preserves the original flavor and nutrients.

93. (D) It involves continuous monitoring and dynamic adjustment of storage gases.
Controlled Atmosphere Storage is an advanced preservation system typically used for bulk agricultural produce. Unlike modified atmosphere packaging, which changes over time, CAS involves continuous monitoring and precise, active regulation of oxygen, carbon dioxide, and nitrogen levels within sealed warehouses. This constant atmospheric adjustment retards respiration and ripening, enabling fruits like apples to be stored for months.

94. (A) P-III, Q-I, R-II
Individual gases in modified atmosphere packages serve specific preservation roles. Carbon dioxide dissolves in the water phase of food to form carbonic acid, exhibiting strong bacteriostatic properties. Nitrogen is an inert, insoluble gas used to displace oxygen and prevent package collapse. High oxygen concentrations are used to maintain the bright red oxymyoglobin pigment in fresh red meats.

95. (B) Destruction of covalent bonds in essential vitamins and flavor compounds.
High Pressure Processing operates by applying extreme isostatic pressure, which primarily affects weak, non-covalent chemical bonds such as hydrogen bonds and electrostatic interactions. Low-molecular-weight compounds held together by strong covalent bonds, such as vitamins, color pigments, and volatile flavor molecules, remain intact during HPP. This selectivity enables the preservation of nutritional and sensory qualities.

96. (B) I, II, and IV only
Controlled atmosphere storage dynamically regulates gas levels in large-scale bulk facilities, whereas modified atmosphere packaging is applied to individual retail containers. In retail packages, gas concentrations change continuously based on produce respiration and film permeability. Both systems require precise refrigeration to control microbial growth, but CAS installations require significantly higher initial capital investments than MAP systems.

97. (A) Respiration rate of produce and gas transmission rate of the film.
Equilibrium Modified Atmosphere packaging is designed for respiring fresh produce. It aims to establish a stable, optimal internal gas composition over time. This equilibrium is achieved by selecting packaging films with specific permeabilities so that the rate of oxygen and carbon dioxide transmission through the film balances the natural respiration rate of the packaged produce.

98. (C) Water mixed with a small amount of food-grade lubricant.
Commercial High Pressure Processing utilizes liquid-mediated isostatic pressure to treat packaged food products. Water is the preferred pressure-transmitting fluid because of its low compressibility, safety, and compatibility with food operations. It is typically mixed with a small concentration of food-grade lubricant to protect hydraulic pump components and prevent internal corrosion of the pressure vessel.

99. (A) Ethylene absorbers are used to accelerate ripening of fruits.
Active packaging incorporates components that interact with the internal atmosphere to extend food shelf life. Ethylene is a natural plant hormone that triggers and accelerates fruit ripening and senescence. Therefore, active packaging utilizes ethylene scavengers or absorbers to remove this gas from the package headspace, thereby delaying ripening and extending the storage life of fresh produce.

100. (D) Statement I is incorrect but Statement II is correct.
High Pressure Processing applied at ambient temperatures is ineffective for destroying bacterial endospores because spores possess highly rigid structures that resist pressure-

NODIA

their hydrophobic nature. This hydrophobicity enables active phenolic compounds, such as thymol and carvacrol, to partition directly into the lipid bilayer of microbial cell membranes. This accumulation disrupts membrane structural integrity, causing increased permeability, leakage of critical intracellular components, and cell death.

138. (B) They improve the solubility, stability, and delivery of essential oils.
Nano-emulsions are colloidal dispersions with droplet sizes below one hundred nanometers, making them optically transparent. In food preservation, they are used to encapsulate lipophilic antimicrobials like plant essential oils. This encapsulation significantly improves their solubility in aqueous food matrices, protects them from degradation, and enhances their delivery and contact with target microbial cell membranes.

139. (A) P-III, Q-I, R-IV, S-II
Natural antimicrobials extracted from plants contain specific active chemical compounds responsible for inhibiting microorganisms. Clove extract is rich in eugenol, garlic contains the sulfur compound allicin, mustard contains allyl isothiocyanate, and cinnamon contains cinnamaldehyde. These distinct bioactives target different physiological structures in microbial cells to prevent food spoilage and control pathogens.

140. (C) They are highly resistant to digestion by human gastrointestinal proteases.
Bacteriocins are ribosomally synthesized antimicrobial peptides produced by bacteria, primarily lactic acid strains. While they are highly effective against closely related foodborne pathogens, they are proteins and are easily digested and inactivated by proteolytic enzymes in the human gastrointestinal tract. This rapid digestion ensures they do not disrupt the consumer's gut microbiota, supporting their safety.

141. (A) I, II, and III only
Hurdle technology combines multiple preservation parameters to achieve a synergistic effect, where the total inhibition of microorganisms is greater than the sum of individual factors. This multi-target approach allows the use of milder treatments, which improves the sensory and nutritional quality of foods. The concept is highly applicable to both liquid and solid food products.

142. (C) Trapping active bioactives in nanoscale vesicles to protect and release them.
Nano-encapsulation involves trapping active, health-promoting bioactive compounds or natural antimicrobials within nanoscale carriers, such as liposomes, polymeric nanoparticles, or solid lipid nanoparticles. This technology protects sensitive ingredients from environmental degradation, masks undesirable tastes, and enables controlled, targeted release of the active agents into the food matrix to extend shelf life.

143. (B) Silver nanoparticles
Silver nanoparticles are widely studied and applied in active food packaging due to their broad-spectrum antimicrobial properties. Incorporated into polymer films, they slowly release silver ions, which interact with bacterial cell walls, disrupt proteins, and induce oxidative stress. This antimicrobial action effectively inhibits foodborne pathogens and spoilage organisms on the surface of packaged foods.

144. (D) It is a broad-spectrum antibiotic effective against gram-negative cells.
Natamycin is a natural polyene antimycotic produced by the bacterium Streptomyces natalensis. It targets ergosterol in fungal membranes to inhibit yeasts and molds, making it highly effective for surface treatment of cheeses and dry sausages. However, it is completely ineffective against bacteria, including Gram-negative organisms, because bacterial cell membranes do not contain the target sterol structures.

145. (A) Both Statement I and Statement II are correct.
Chitosan is a natural, cationic biopolymer produced through the chemical deacetylation of chitin, which is extracted from waste crustacean shells. It exhibits strong antimicrobial properties by interacting with negatively charged microbial cell membranes, causing leakage. Additionally, its excellent film-forming capacity makes chitosan highly suitable for developing biodegradable, active edible coatings to preserve fresh produce.

146. (C) Lysozyme – Egg-white enzyme that degrades bacterial cell walls
Natural antimicrobials are sourced from various biological origins. Lysozyme is a well-documented enzyme extracted from chicken egg whites that targets and hydrolyzes the beta-1,4-glycosidic bonds in the peptidoglycan cell walls of Gram-

Click Here to Buy book on Amazon

extractions. In contrast, diagnostic ultrasound utilizes high frequencies and low intensities, passing sound waves through food to perform non-destructive quality analysis without altering the product.

110. (C) High concentration of Vitamin C in the liquid.
The efficacy of Pulsed Electric Field treatment is influenced by the physical and electrical properties of the food. High electrical conductivity reduces field strength, air bubbles cause electric arcing, and large particulates prevent uniform treatment. However, the presence of chemical nutrients like Vitamin C does not interfere with electrical transmission or membrane electroporation, making PEF highly suitable for juices.

111. (A) I, II, and III only
Power ultrasound can tenderize meat by disrupting muscle fibers and myofibrillar proteins, and it can be combined with moderate heat in thermosonication to enhance microbial inactivation. The process generates localized cavitation bubbles that implode, creating extreme hot spots of temperature and pressure. The ultrasound frequencies used exceed twenty kilohertz, which is well above the human hearing range.

112. (D) Transmembrane potential
In Pulsed Electric Field processing, applying an external electric field polarizes charges across the microbial cell membrane, inducing a voltage difference. To achieve cell inactivation through irreversible electroporation, the external field strength must be high enough to cause this induced transmembrane potential to exceed a critical limit, typically around one volt, leading to membrane rupture.

113. (A) The minimum acoustic pressure needed to produce bubbles in liquids.
The acoustic cavitation threshold represents the minimum acoustic pressure amplitude required to initiate cavitation in a liquid medium. Below this threshold, the sound waves propagate through the fluid without causing the cohesive forces of the liquid to fail. Once exceeded, the negative pressure during rare-faction cycles exceeds these forces, forming microbubbles that drive physical and chemical changes.

114. (C) PEF is widely used to achieve commercial sterility in solid cuts of meat.
While Pulsed Electric Field technology is used as a pre-treatment to assist juice extraction from sugar beets and modify potato structures to improve cutting, it is not used to commercially sterilize solid meats. PEF is primarily a pasteurization technology that is ineffective against bacterial endospores and cannot achieve uniform electric field distribution throughout thick, solid, non-homogeneous meats.

115. (C) Statement I is correct but Statement II is incorrect.
Sonoporation describes the physical process where ultrasound-induced acoustic cavitation increases the permeability of cell membranes. Although cavitation bubbles produce extreme temperatures and pressures locally upon collapse, these phenomena are highly microscopic and localized. Consequently, they do not cause a significant or uniform rise in the bulk temperature of the food product, which remains relatively cool.

116. (D) HPP – Inactivation via isostatic pressure
Non-thermal food processing technologies preserve foods using distinct physical mechanisms. High Pressure Processing inactivates microorganisms by applying extreme isostatic pressure uniformly throughout the food, which destabilizes cellular membranes and denatures crucial proteins. In contrast, pulsed electric fields rely on electroporation, power ultrasound operates via acoustic cavitation, and ultraviolet light inactivates microorganisms by damaging their DNA.

117. (B) Entrapped gas bubbles in the juice.
Electrical arcing or sparking inside a Pulsed Electric Field treatment chamber occurs when there is a localized breakdown of dielectric properties within the liquid food. Entrapped gas or air bubbles have a significantly lower dielectric constant than liquid juice. Under high-voltage fields, these bubbles deform and trigger electrical discharges, causing localized heating, electrode damage, and off-flavor development.

118. (C) Electroporator – Measures the frequency of ultrasound waves
Ultrasound equipment utilizes specific components to generate and transmit acoustic energy. Transducers convert electrical or magnetic energy into physical vibrations, and

Downloaded from www.pdf.tube

the sonotrode or horn amplifies these vibrations. An electroporator, however, is an electrical system used to deliver high-voltage pulses in pulsed electric field processing and is completely unrelated to measuring acoustic wave frequencies.

119. (D) Number of pulses multiplied by the pulse width.
In Pulsed Electric Field processing, the total treatment time represents the cumulative duration that the food material is directly exposed to the high-voltage electrical field. This critical parameter is calculated by multiplying the total number of pulses applied to the product within the treatment chamber by the individual width or duration of each pulse.

120. (A) Sonolysis of water into hydroxyl radicals and hydrogen atoms.
The violent collapse of microbubbles during acoustic cavitation generates extreme localized temperatures and pressures. Under these severe conditions, water molecules present in the vapor phase of the bubble undergo thermal dissociation, a chemical process termed sonolysis. This cleavage splits water molecules into highly reactive hydroxyl free radicals and hydrogen atoms, which initiate secondary oxidative reactions.

121. (B) Dipolar rotation and ionic polarization
Microwave heating generates heat within food products through two primary electromagnetic mechanisms. Dipolar rotation occurs when polar molecules, primarily water, continually realign themselves with the rapidly alternating microwave electric field, generating frictional heat. Ionic polarization occurs when dissolved ions migrate back and forth in response to the electric field, colliding with other molecules to produce heat.

122. (A) Both A and R are true and R is the correct explanation of A.
Ohmic heating provides rapid and highly uniform heating of liquid foods containing suspended solid particulates. This performance is achieved because the alternating electrical current passes directly through the entire food matrix, generating heat internally due to the electrical resistance of both the liquid and solid phases. This volumetric heating eliminates the heat transfer limitations of conventional processing.

123. (A) It uses partially ionized gas with ions and electrons near room temperature.
Non-thermal or cold plasma is generated by applying energy to a gas, creating a partially ionized state. In this system, the free electrons reach high temperatures, while the heavier ions and neutral gas molecules remain near ambient room temperature. This low bulk temperature enables the treatment of heat-sensitive food surfaces without causing thermal damage.

124. (A) P-I, Q-II
Electromagnetic heating technologies operate at specific frequencies allocated by international regulations for industrial, scientific, and medical applications. Microwave heating systems typically utilize frequencies of twenty-four hundred fifty megahertz or nine hundred fifteen megahertz. Radio frequency heating systems operate at longer wavelengths and use lower frequencies, most commonly twenty-seven point twelve megahertz.

125. (D) It leaves a toxic chemical residue on food surfaces after use.
Ozone is a powerful oxidizing gas widely utilized for water treatment and surface sanitization due to its high efficacy against vegetative pathogens. A key advantage of ozone is its instability, which causes it to decompose rapidly into standard, non-toxic diatomic oxygen. Consequently, it leaves no chemical residue on food contact surfaces or processed products.

126. (B) I, II, and IV only
Ohmic heating, also known as Joule heating, relies on passing an alternating electrical current through food, making the process highly dependent on the electrical conductivity of the material. Because heat is generated internally, the process avoids hot surfaces and can heat solid particles and liquid carriers at similar rates, provided their electrical conductivities are well-matched.

127. (B) The ability of food to convert microwave energy into heat.
In microwave processing, the loss tangent represents the ratio of the dielectric loss factor to the dielectric constant. This thermodynamic parameter indicates the efficiency with which a food material can absorb electromagnetic energy and convert it into thermal energy. A higher loss tangent value signifies that the food will heat more rapidly under microwave radiation.

NODIA

128. (D) 200 - 280 nm
The ultraviolet spectrum is divided into different wave bands, with the UV-C range, spanning from two hundred to two hundred eighty nanometers, exhibiting the highest germicidal effectiveness. This short-wavelength radiation peaks around two hundred fifty-four nanometers, which corresponds to the absorption spectrum of microbial DNA. It induces pyrimidine dimer formation, blocking replication and destroying microorganisms.

129. (A) It causes a dramatic rise in bulk temperature to sterilize food.
Cold plasma is a non-thermal surface treatment generated at atmospheric pressure. The technology utilizes high-voltage discharges to produce reactive species that destroy surface microorganisms, but it does not cause a dramatic rise in the bulk temperature of the food. This characteristic makes it highly suitable for sanitizing heat-sensitive food packaging and fresh produce.

130. (A) Both Statement I and Statement II are correct.
Radio frequency heating utilizes longer electromagnetic wavelengths than microwave systems, which enables significantly deeper penetration depths into food products. This deep penetration ensures uniform heat distribution, making RF technology highly effective for industrial post-baking drying of biscuits and rapid, uniform thawing of large, frozen blocks of meat without causing surface overheating.

131. (A) Cold Plasma – Oxidative stress on membranes via reactive species
Novel preservation technologies utilize unique physical mechanisms to inactivate microorganisms. Cold plasma generates reactive oxygen and nitrogen species that induce severe oxidative stress, causing lipid peroxidation and cell membrane etching. In contrast, Ohmic and microwave heating rely primarily on thermal denaturation of proteins, while ozone inactivates cells through direct oxidation of cellular components.

132. (D) The conductivities of both components should be as closely matched as possible.
To achieve uniform heating in a multi-phase food system during Ohmic processing, the electrical conductivities of the liquid broth and solid potato cubes must be closely matched. If one phase is significantly more conductive, the electrical current will preferentially flow through it, leading to non-uniform heating, localized under-processing, or overcooking of the more conductive phase.

133. (B) Ozone stability – Highly stable gas, can be stored in cylinders for months
Ozone is an extremely unstable triatomic gas that rapidly decomposes back into diatomic oxygen. Because of this high reactivity, ozone cannot be stored or transported in cylinders. Instead, it must be generated on-site using corona discharge systems or ultraviolet light immediately before application in aqueous washes or gas treatments for food preservation.

134. (C) The heating rate accelerates, potentially leading to thermal runaway.
In Ohmic heating, the electrical conductivity of food increases as temperature rises because ion mobility increases. Under a constant applied voltage, this rising conductivity increases current flow through the material, which accelerates the volumetric heating rate over time. If not controlled, this positive feedback loop can lead to thermal runaway and localized boiling.

135. (D) Lipid peroxidation and etching of the cell membrane.
The reactive oxygen and nitrogen species generated during cold plasma treatment interact directly with the outer structures of bacterial cells. These highly reactive radicals initiate lipid peroxidation of the cell membrane and oxidize outer wall proteins, causing physical damage often termed etching. This structural compromise leads to cell leakage, loss of integrity, and rapid microbial death.

136. (A) Gram-positive bacteria and spore-formers.
Nisin is a polycyclic peptide bacteriocin produced by Lactococcus lactis. It acts by binding to lipid II in bacterial cell membranes, which inhibits cell wall synthesis and forms pores. Nisin is highly active against Gram-positive bacteria and spore-formers, including Listeria and Clostridium, but is ineffective against Gram-negative cells, yeasts, and molds due to their outer membrane structures.

137. (A) Both A and R are true and R is the correct explanation of A.
Essential oils extracted from plants exhibit broad-spectrum antimicrobial activity due to

Click Here to Buy book on Amazon

off when not in use, eliminating the need to transport or replenish radioactive materials. Both methods utilize ionizing radiation.

82. (C) Gray (Gy)
The absorbed dose of ionizing radiation in food processing represents the amount of radiation energy deposited per unit mass of food material. The internationally recognized metric unit for this measurement is the Gray, defined as the absorption of one joule of radiation energy per kilogram of matter. This unit has replaced the older unit, the rad.

83. (A) It has low penetration, limiting its use to surface or air treatments.
Ultraviolet light is a form of non-ionizing radiation that exerts germicidal effects by damaging microbial DNA. However, its primary limitation in food preservation is its extremely low penetration depth, as it is easily absorbed, scattered, or blocked by solid food components and turbid liquids. Consequently, its application is restricted to air, water, and smooth surfaces.

84. (D) Sorbic acid is more soluble in water than potassium sorbate.
Sorbic acid is a lipophilic organic acid with limited solubility in aqueous systems. To facilitate uniform distribution in foods, it is commonly manufactured and applied as its potassium salt, potassium sorbate, which possesses high water solubility. Once dissolved in the aqueous phase of food, the salt dissociates, and the active, undissociated antimicrobial sorbic acid is formed.

85. (D) Statement I is incorrect but Statement II is correct.
Food irradiation does not induce radioactivity in processed foods. The energy levels of standard commercial sources, such as Cobalt-60 gamma rays emitting at one point one seven and one point three three mega-electron volts, are well below the ten mega-electron volt threshold required to split atomic nuclei and induce artificial radioactivity in the food matrix.

86. (C) Natamycin – Target yeasts and molds on cheese surfaces
Natamycin is a naturally occurring polyene macrolide antimycotic produced by Streptomyces natalensis. It binds specifically to ergosterol in fungal cell membranes, making it highly effective against yeasts and molds. Because bacterial membranes lack sterols, natamycin is completely inactive against bacteria, allowing its use on cheese surfaces to prevent mold spoilage without affecting bacterial ripening.

87. (D) Low-dose irradiation process
Low-dose ionizing radiation is an effective physical preservation method used to extend the shelf life of root crops. Exposing potatoes or onions to low radiation doses, typically below fifteen hundredths of a kilogray, disrupts the hormone systems responsible for cell division in the sprouts. This treatment successfully inhibits sprouting during long-term storage without affecting quality.

88. (A) Sulfur dioxide – Long-chain organic polymer
Sulfur dioxide is a simple, inorganic gaseous chemical compound with the molecular formula SO2, not a long-chain organic polymer. It dissolves in water to form sulfite, bisulfite, and sulfurous acid, which exert antimicrobial and antioxidant functions in food systems. Sorbic, benzoic, and propionic acids are all organic carboxylic acids of varying chain structures.

89. (B) The radiation dose was absorbed uniformly throughout the food.
The dose uniformity ratio is the ratio of the maximum absorbed radiation dose to the minimum absorbed dose within a processed food package. A ratio close to one point zero indicates that the ionizing energy was absorbed evenly throughout the product volume. This uniformity is essential to ensure that all parts of the food receive the target sterilization dose.

90. (B) The generation of reactive oxygen species from water radiolysis.
Ionizing radiation destroys microorganisms through direct and indirect pathways. The direct mechanism involves splitting chemical bonds in vital microbial DNA molecules. The indirect mechanism, which is highly prevailing in high-moisture foods, occurs when radiation energy splits water molecules, a process called radiolysis. This radiolysis generates highly reactive free radicals that attack and destroy essential cell structures.

91. (A) Oxygen, Carbon dioxide, and Nitrogen
Modified Atmosphere Packaging alters the gaseous environment inside a food package to extend shelf life. This technique typically utilizes controlled blends of oxygen, carbon dioxide, and

NODIA

positive bacteria. In contrast, natamycin is bacterial, lactoferrin is milk-derived, and phytoalexins are synthesized by plants in response to stress.

147. (A) Hurdle technology
Designing food stability by combining multiple sub-lethal preservation factors is a practical application of hurdle technology. In this product, the formulation utilizes three distinct barriers: lowering water activity to zero point eight eight, reducing pH to four point two, and adding potassium sorbate. These mild hurdles work synergistically to prevent microbial spoilage while preserving sensory quality.

148. (D) MIC – Highest concentration of an antimicrobial that stimulates growth.
The term MIC represents the Minimum Inhibitory Concentration, which is defined as the lowest concentration of an antimicrobial agent that completely prevents the visible growth of a microorganism. It does not represent a high concentration that stimulates growth, as antimicrobials are designed to inhibit or destroy cells rather than promote their metabolic activity.

149. (B) The lowest concentration of the agent that prevents visible growth.
The minimum inhibitory concentration is a fundamental microbiological parameter used to evaluate the efficacy of antimicrobial agents. It represents the lowest concentration of an active compound, such as a plant extract or preservative, that completely prevents visible in vitro growth of a target microorganism under standardized incubation conditions, serving as a baseline for formulation.

150. (C) Disruption of the cell membrane, causing leakage of internal components.
Phenolic compounds from plant extracts are highly lipophilic molecules that partition into the hydrophobic core of microbial cell membranes. This accumulation disrupts the structural arrangement of the lipid bilayer, which increases membrane permeability. Consequently, this physical disruption causes the leakage of essential intracellular ions and metabolites, leading to cell death.

www.nodia.in

Downloaded from www.pdf.tube

CHAPTER 18
Food Additives and Packaging

1. Which of the following best describes the primary technological function of a food additive?
(A) To enhance the nutritional value of a food product for specific dietary formulations.
(B) To purposely impart a technological effect in the manufacture or processing of food.
(C) To serve as an unintentional chemical contaminant introduced during food processing.
(D) To replace essential raw materials in the formulation to lower production costs.

2. Consider the following statements regarding the technological functions of food additives:
1. Preservatives extend shelf life by protecting food against deterioration caused by microorganisms.
2. Emulsifiers prevent the separation of oil and water in food systems.
3. Sequestrants are used to increase the oxidative degradation of fats.
4. Firming agents make or keep tissues of fruits and vegetables crisp.

Which of the statements given above are correct?
(A) 1, 2, and 3
(B) 1, 2, and 4
(C) 2, 3, and 4
(D) 1, 3, and 4

3. Which of the following statements is correct regarding the use of Class II preservatives in food regulation?
(A) Their usage is restricted to specific food categories with defined maximum safe limits.
(B) They can be added to any commercial food product in unlimited quantities without safety limits.
(C) They include standard household kitchen ingredients like table salt, sucrose, and vinegar.
(D) They are completely prohibited in all thermally sterilized and packaged food products.

4. Match List I with List II:
List I: (Preservative)
P. Sorbic acid
Q. Sulphur dioxide
R. Nitrites
S. Benzoates
List II: (Mechanism of Action)
I. Inhibits Clostridium botulinum spores in cured meats
II. Inhibits yeast and mold by disrupting cell membrane proton gradients
III. Blocks cellular uptake of amino acids in yeast and molds at low pH
IV. Cleaves disulfide bonds and inhibits non-enzymatic browning
Choose the correct option:
(A) P-III, Q-IV, R-I, S-II
(B) P-II, Q-IV, R-I, S-III
(C) P-III, Q-I, R-IV, S-II
(D) P-II, Q-I, R-IV, S-III

NODIA

5. Identify the incorrect statement regarding the safe limits and application of chemical preservatives.
(A) Sodium benzoate is most effective as a preservative in low-acid foods with a pH above 6.0.
(B) Propionic acid and its salts are primarily used to inhibit mold growth in bakery products.
(C) The maximum permitted level of sulphur dioxide in most fruit juices is strictly regulated to prevent toxicity.
(D) Parabens are more active against molds and yeasts than against bacteria.

6. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Nitrates and nitrites are widely used in the curing of meat products.
Reason (R): They fix the characteristic pink colour of cured meat and strongly inhibit the growth of Clostridium botulinum.
In the light of the above statements, choose the correct answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

7. What is the precise definition of a food antioxidant in the context of food technology?
(A) A substance that restores the natural raw colour of food products that is lost during thermal processing.
(B) A substance used to preserve food by retarding deterioration, rancidity, or discoloration due to oxidation.
(C) A substance added to food formulations to significantly reduce microbial loads and prevent fungal spoilage.
(D) A substance that actively absorbs atmospheric moisture to prevent highly hygroscopic foods from caking.

8. Read the given statements and select the correct option:
Statement I: BHA and BHT are synthetic antioxidants that are highly stable at high temperatures, making them suitable for baked and fried foods.
Statement II: Tocopherols are synthetic antioxidants that are strictly prohibited in organic food processing.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

9. All of the following are synthetic antioxidants permitted for use in food EXCEPT:
(A) Butylated hydroxyanisole (BHA)
(B) Tertiary butylhydroquinone (TBHQ)
(C) Butylated hydroxytoluene (BHT)
(D) Ascorbyl palmitate

10. A food technologist is formulating a low-fat mayonnaise and notices that the oil phase separates rapidly from the aqueous phase. To stabilize this emulsion, which specific food additive should be incorporated?
(A) Lecithin
(B) Sodium bicarbonate
(C) Butylated hydroxytoluene
(D) Calcium propionate

11. Which of the following emulsifiers is characterized by being an ester of fatty acids with polyoxyethylene sorbitan?
(A) Mono and diglycerides
(B) Polysorbates
(C) Lecithin
(D) Stearoyl lactylates

12. Identify the correct pair of a stabilizing agent and its primary botanical or biological source.
(A) Pectin – Extracted from the cell walls of brown seaweed species
(B) Guar gum – Endosperm of Cyamopsis tetragonoloba seeds
(C) Carrageenan – Purified structural components of citrus peels
(D) Alginate – Polysaccharide extracted from standard red algae

13. Consider the following statements regarding stabilisers, thickeners, and gelling agents:
1. High-methoxyl pectin forms gels in the presence of high sugar concentrations and low pH.
2. Low-methoxyl pectin requires divalent cations like calcium for gel formation.
3. Kappa-carrageenan produces soft, elastic gels in the presence of calcium ions.
4. Guar gum is a galactomannan that acts as a primary gelling agent rather than a thickener.

Which of the statements given above are correct?
(A) 1 and 2
(B) 1, 2, and 3
(C) 2, 3, and 4
(D) 1, 3, and 4

14. Which of the following represents the most appropriate justification for using a combination of thickeners rather than a single gum in a food formulation?
(A) To significantly increase the caloric density and nutritional value of the final packaged food.
(B) To bypass regulatory maximum limit restrictions on individual chemical additives used in the recipe.
(C) To exploit synergistic interactions yielding superior viscosity at lower total polymer concentrations.
(D) To ensure that the food product remains completely shelf-stable without thermal pasteurization steps.

Click Here to Buy book on Amazon

(D) P-I, Q-III, R-IV, S-II

46. You are tasked with selecting a packaging material for fresh red meat to preserve its bright cherry-red color (oxymyoglobin) during display. What specific barrier competency is required of the packaging film?
(A) Absolute moisture barrier with zero oxygen permeability.
(B) High carbon dioxide permeability with zero light transmission.
(C) High oxygen permeability combined with a good moisture barrier.
(D) Complete blocking of all gases to create a hard vacuum.

47. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Moisture absorbers in active packaging often contain silica gel or calcium oxide.
Reason (R): These desiccants prevent condensation inside the package, thereby retarding mold growth in low-moisture foods.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

48. Identify the incorrect statement regarding a packaging material and its primary compositional origin.
(A) Glass – Silica, sodium carbonate, and calcium carbonate
(B) Tinplate – Low-carbon steel coated with a thin layer of tin
(C) Polypropylene (PP) – Polymerized chains of ester monomers
(D) Cellophane – Regenerated cellulose derived from wood pulp

49. Under FSSAI regulations, what is the core concept distinguishing Global Migration from Specific Migration when testing food contact plastics?
(A) Global migration measures only hazardous carcinogenic substances, while specific migration measures all synthetic non-toxic substances in the material.
(B) Global migration assesses the total non-volatile transfer to food, whereas specific migration tracks the transfer of one specific identifiable chemical.
(C) Global migration is tested exclusively at room temperature for brief periods, whereas specific migration requires high heat for prolonged intervals.
(D) Global migration applies to imported packaging materials indiscriminately, whereas specific migration applies to domestically produced packaging.

50. What is the primary cause-effect relationship that necessitates the use of counter-pressure during the cooling phase of retort pouch thermal processing?
(A) The intensive sterilizing heat breaks down the plastic layers, causing them to shrink rapidly and compromise the seal integrity of the pouch.
(B) The rapid cooling phase causes the internal food product to expand suddenly, stretching and weakening the laminated pouch materials.
(C) The counter-pressure physically catalyzes the immediate chemical activation of oxygen scavengers embedded directly in the pouch layers.
(D) The internal pressure inside the pouch exceeds the external pressure of the cooling water, which can cause the pouch seals to burst.

51. Which of the following compounds is commonly incorporated into packaging films to impart active antimicrobial properties?
(A) Silver nanoparticles
(B) Calcium carbonate
(C) Titanium dioxide
(D) Butylated hydroxytoluene

NODIA

52. Arrange the typical layers of a retort pouch in sequential order from the outside (environment facing) to the inside (food contact):
1. Aluminium foil
2. Polyester (PET)
3. Cast Polypropylene (CPP)
4. Adhesive layers (between primary layers)

(A) 2, 4, 1, 4, 3
(B) 3, 4, 1, 4, 2
(C) 1, 4, 2, 4, 3

per kg of body weight per day.
(A) 2, 1, 3, 4
(B) 1, 2, 3, 4
(C) 2, 3, 1, 4
(D) 1, 3, 2, 4

23. Which of the following statements is correct regarding the regulatory framework for additives under FSSAI Schedule 1?
(A) Schedule 1 exclusively lists colorants and preservatives, while other additives are governed by the Bureau of Indian Standards (BIS).
(B) Schedule 1 provides the list of permitted food additives, their applicable food categories, and their maximum usage levels.
(C) The use of additives is governed by the principle of "Good Manufacturing Practices" (GMP) only, without any numerical maximum usage limits.
(D) It supersedes and strictly contradicts the principles laid out in the CODEX General Standard for Food Additives.

24. All of the following are fundamental principles of the CODEX General Standard for Food Additives (GSFA) EXCEPT:
(A) The additive must present no unacceptable risk to the health of the consumer.
(B) The use of the additive must be technologically justified.
(C) The additive can be used to disguise faulty raw materials or unhygienic manufacturing practices.
(D) The additive must be used at the lowest level necessary to achieve the intended technological effect.

25. According to the principles of food packaging, what does the term "containment" specifically refer to?
(A) Shielding the sensitive food product from oxygen, light, moisture, and external microbial contamination.
(B) Providing essential product information, such as ingredients and expiration dates, to the consumer.
(C) The chemical capacity of the packaging material to interact actively with the food to extend shelf life.
(D) The physical holding of the product in a defined space to allow handling and transportation without spillage.

NODIA

26. Read the given statements and select the correct option:
Statement I: Glass is considered an inherently superior packaging material because it is completely impermeable to gases and vapours.
Statement II: A major disadvantage of metal packaging is its high susceptibility to thermal shock during pasteurization processes.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

27. Which of the following properties makes Polyethylene Terephthalate (PET) the most appropriate choice for packaging carbonated beverages?
(A) It offers extreme structural resistance to high-temperature commercial retort processing operations.
(B) It provides an excellent barrier against carbon dioxide permeation and is highly lightweight.
(C) It possesses a low mechanical tensile strength, allowing for easy expansion during carbonation.
(D) It is a completely biodegradable polymer derived entirely from sustainable renewable resources.

28. A packaging engineer is designing a flexible multi-layer film for a highly oxygen-sensitive food product. Which specific polymer should be incorporated into the core layer of the film to maximize the oxygen barrier?
(A) Low-Density Polyethylene (LDPE)
(B) Ethylene Vinyl Alcohol (EVOH)
(C) High-Density Polyethylene (HDPE)
(D) Polypropylene (PP)

29. An active packaging system utilizes sachets containing iron powder. What is the primary functional concept behind this application?
(A) To scavenge oxygen from the package headspace, thereby preventing lipid oxidation and aerobic spoilage.
(B) To actively absorb excess moisture within the package headspace and prevent rapid fungal mold growth.
(C) To release specific antimicrobial volatile compounds to suppress microbial activity in the package.
(D) To serve as an intelligent visual indicator

(B) Iota-carrageenan
(C) Lambda-carrageenan
(D) Mu-carrageenan

62. Consider the following statements regarding the regulation of synthetic colours in foods under FSSAI:
1. The maximum limit of permitted synthetic food colours generally must not exceed 100 mg/kg in the final food product.
2. Synthetic colours are permitted in raw, unprocessed fresh produce to improve market appeal.
3. Tartrazine, Sunset Yellow, and Ponceau 4R are examples of permitted synthetic colours.
4. Food products containing artificial colours must carry a specific declarative statement on the label.

(A) 1, 2, and 3
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 4

63. Which of the following statements is correct regarding natural flavours used as food additives?
(A) They are synthetically manufactured pure chemical substances that perfectly mimic naturally occurring flavour compounds in food.
(B) They are strictly subject to a rigid regulatory maximum usage limit of exactly 1000 ppm across all global food categories.
(C) They must not contain any volatile organic chemical compounds that could escape during standard thermal food processing.
(D) They are obtained exclusively through physical, microbiological, or enzymatic processes from material of plant or animal origin.

64. Match List I with List II:
List I: (Acidulant)
P. Phosphoric acid
Q. Tartaric acid
R. Acetic acid
S. Malic acid
List II: (Common Food Application)
I. Pickles and condiments
II. Apple-flavoured juices and candies
III. Cola-type carbonated beverages
IV. Baking powders and grape-flavoured products
Choose the correct option:
(A) P-III, Q-IV, R-I, S-II
(B) P-III, Q-II, R-I, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-I, Q-IV, R-III, S-II

65. Identify the incorrect statement regarding baking soda (sodium bicarbonate).
(A) It requires an acidic ingredient in the batter to fully react and release carbon dioxide.
(B) It provides a double-acting leavening effect, releasing gas both during mixing and baking.
(C) If used without an acid, it can leave a bitter, soapy taste due to the formation of sodium carbonate.
(D) It slightly increases the pH of the batter, which can enhance browning reactions.

66. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Humectants are critical components in the formulation of intermediate moisture foods (IMF) like soft candies and fruit leathers.
Reason (R): Humectants bind free water, effectively lowering the water activity (a_w) and preventing microbial proliferation without making the product dry.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

67. What is the definition of the Specific Migration Limit (SML) in the context of food packaging regulations?
(A) The maximum permitted amount of a given specific substance authorized to migrate from the packaging material into food or food simulants.
(B) The absolute maximum permitted amount of total non-volatile substances allowed to migrate into a specific packaged food product.
(C) The total time required for a specific synthetic polymer film to completely biodegrade in standard municipal landfill conditions.
(D) The critical physical limit at which a flexible multi-layer packaging film tears or ruptures

Downloaded from www.pdf.tube

correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

37. Which of the following best defines the role of a glazing agent as a food additive?
(A) A substance applied to the external surface of a food to impart a shiny appearance or provide a protective coating.
(B) An active chemical agent that prevents highly hygroscopic powders from forming lumps and cakes during storage.
(C) A compound that accelerates the natural biological ripening process of harvested green fruits in warehouse environments.
(D) An organic additive that creates and stabilizes a robust foam structure in highly aerated liquid food mixtures.

38. Read the given statements and select the correct option:
Statement I: Saccharomyces cerevisiae leavens bread by converting fermentable sugars into carbon dioxide and ethanol under predominantly anaerobic conditions.
Statement II: Chemical leavening agents generally produce gas more slowly than yeast, requiring longer proofing times for bread doughs.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

39. All of the following food additives are generally recognized as safe (GRAS) or permitted within specific limits EXCEPT:
(A) Tartrazine
(B) Potassium bromate
(C) Sodium benzoate
(D) Ascorbic acid

40. A bakery is experiencing rapid spoilage of its sliced bread due to rope formation and mold growth. To resolve this case, which preservative should be incorporated into the dough formulation?
(A) Potassium metabisulphite
(B) Sodium nitrite
(C) Calcium propionate
(D) Natamycin

41. Lecithin, a powerful natural emulsifier, is predominantly extracted on a commercial scale from which of the following sources?
(A) Sunflower seeds
(B) Egg whites
(C) Corn starch
(D) Soybeans

42. Identify the correct pair of a thickening agent and its unique physical characteristic.
(A) Xanthan gum – Exhibits extreme shear-thinning (pseudoplastic) behaviour
(B) Agar-agar – Dissolves completely in cold water without heating
(C) Gum arabic – Forms highly viscous solutions at very low concentrations (1-2%)
(D) Locust bean gum – Forms strong thermoreversible gels entirely on its own

43. Consider the following non-nutritive or intense sweeteners:
1. Aspartame
2. Sucralose
3. Saccharin
4. Stevil glycosides
Which of these sweeteners is/are stable under high-temperature baking conditions?
(A) 1 and 3
(B) 2, 3, and 4
(C) 1, 2, and 4
(D) 1 only

44. Which of the following is the most appropriate additive to function simultaneously as an acidulant, a pH regulator, and a chelating agent in a fruit-based beverage?
(A) Lactic acid
(B) Citric acid
(C) Acetic acid
(D) Malic acid

NODIA

45. Match List I with List II:
List I: (Additive Name)
P. Colours
Q. Preservatives
R. Antioxidants
S. Thickeners/Stabilisers
List II: (Corresponding INS/E-Number series)
I. 300 - 399
II. 400 - 499
III. 200 - 299
IV. 100 - 199
Choose the correct option:
(A) P-IV, Q-III, R-I, S-II
(B) P-IV, Q-II, R-I, S-III
(C) P-III, Q-IV, R-II, S-I

(C) Potassium sorbate
(D) Sulphur dioxide

77. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Polysorbates are frequently used as emulsifiers in ice cream formulations.
Reason (R): They promote the destabilization of the fat emulsion during freezing, which is necessary for proper air incorporation (overrun) and a smooth texture.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

78. Identify the incorrect statement regarding the variants of tocopherols (Vitamin E) and their antioxidant activity.
(A) Alpha-tocopherol – Highest biological vitamin activity
(B) Delta-tocopherol – Lowest biological vitamin activity but highest in-vitro antioxidant potency
(C) Beta-tocopherol – Acts as a pro-oxidant in all food systems
(D) Gamma-tocopherol – Primary form found in soybean oil

79. The fundamental concept underlying the function of antioxidants like BHT and TBHQ in lipid systems is their ability to:
(A) Chemically sequester trace transition metal ions such as iron and copper in foods.
(B) Lower the overall redox potential by completely removing dissolved oxygen from the food.
(C) Form a robust physical barrier around dispersed fat droplets to prevent oxygen contact.
(D) Scavenge free radicals and interrupt the propagation phase of lipid auto-oxidation.

80. What is the direct cause-effect relationship of an emulsifier forming micelles in a food system?
(A) It causes the immediate separation of the oil and water phases in the final food system.
(B) It significantly increases raw water activity, rapidly promoting unwanted bacterial growth.
(C) It lowers the interfacial tension between immiscible liquids, stabilizing the emulsion.
(D) It actively degrades the crystalline starch matrix, leading to rapid retrogradation and staling.

81. High-methoxyl (HM) pectin requires specific conditions to form a gel. Which of the following conditions is mandatory?
(A) High pH (> 6.0) and highly concentrated divalent calcium ions
(B) Low pH (< 3.5) and high soluble solids content (sugar $> 55\%$)
(C) Neutral pH (7.0) and very low soluble solids (sugar $< 20\%$)
(D) Low pH (< 3.5) and highly concentrated divalent calcium ions

82. Arrange the following stages of a typical aseptic packaging operation in the correct sequence:
1. Sterilization of the packaging material.
2. Filling the sterile product into the sterile container.
3. Independent thermal sterilization of the food product.
4. Hermetic sealing in a sterile environment.

(A) 1, 3, 2, 4
(B) 3, 1, 2, 4
(C) 1, 2, 3, 4
(D) 3, 2, 1, 4

83. Which of the following statements is correct regarding the behaviour of guar gum as a food additive?
(A) It is a cold-water-soluble polysaccharide that functions primarily as a highly effective thickener.
(B) It forms strong, thermally reversible elastic gels upon cooling to room temperature.
(C) Its viscosity significantly increases when exposed to high temperatures and high shear forces.
(D) It requires the mandatory addition of divalent calcium ions to fully hydrate and function.

84. All of the following artificial sweeteners are generally stable under standard commercial baking temperatures EXCEPT:
(A) Sucralose
(B) Saccharin

Click Here to Buy book on Amazon

(D) 2, 1, 3, 4 (ignoring adhesives)

53. Which of the following statements is correct regarding the comparison between LDPE and HDPE packaging films?
(A) LDPE has a higher degree of polymer chain branching than HDPE, making it more flexible.
(B) HDPE is highly transparent and stretchable, whereas standard LDPE is highly stiff and opaque.
(C) LDPE provides a superior structural barrier to atmospheric oxygen compared to advanced EVOH.
(D) HDPE has a lower melting point than LDPE, making it completely unsuitable for rigid containers.

54. All of the following are advantageous properties of glass as a food packaging material EXCEPT:
(A) It is chemically inert and non-reactive with most foods.
(B) It is impermeable to gases and vapours.
(C) It can be easily hot-filled and hermetically sealed.
(D) It possesses a low tare weight relative to its volume.

55. In the context of risk assessment for food additives, what does NOAEL stand for?
(A) National Organic Additive Evaluation Limit
(B) No-Observed-Adverse-Effect Level
(C) Nominal Operative Additive Exposure Limit
(D) Non-Oxidative Active Elemental Limit

56. Read the given statements and select the correct option:
Statement I: The Codex General Standard for Food Additives (GSFA) uses a hierarchical food category system to assign additive permissions.
Statement II: According to GSFA, if an additive is permitted in a general category, it is automatically prohibited in all its sub-categories.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

57. Which of the following features represents the most appropriate example of the "communication" principle in food packaging?
(A) A tamper-evident safety band applied tightly on a bottle cap.
(B) A high-barrier multi-layered metallized polymer film layer.
(C) The corrugated structural fluting in a cardboard shipping box.
(D) The printed nutritional facts panel and allergen declarations.

58. In the meat processing industry, sodium ascorbate is frequently added alongside sodium nitrite. What is the primary purpose of this specific combination in a meat curing case?
(A) Ascorbate accelerates the reduction of nitrite to nitric oxide, improving colour formation and reducing residual nitrite levels.
(B) Ascorbate significantly raises the pH of the processed meat matrix to completely prevent spontaneous nitrite degradation.
(C) Ascorbate acts primarily as a high-affinity thickener to bind excess water and improve texture in the meat matrix.
(D) Ascorbate chemically neutralizes the strong salty taste of the curing salts to improve overall sensory acceptability.

59. When two antioxidants (e.g., BHA and BHT) are used together, they often exhibit a combined effect that is greater than the sum of their individual effects. What is this concept called?
(A) Antagonism
(B) Synergism
(C) Chelation
(D) Carry-over effect

60. Identify the incorrect statement regarding mono- and diglycerides used as food additives.
(A) They are non-ionic emulsifiers commonly synthesized by the direct transesterification of natural triglycerides with glycerol.
(B) They possess a very high Hydrophilic-Lipophilic Balance (HLB) value, making them excellent for oil-in-water (O/W) emulsions.
(C) They are highly effective chemical agents at preventing starch retrogradation and crumb staling in various baked goods.
(D) They constitute the single largest group of functional emulsifiers utilized in the commercial food industry by volume.

61. Which type of carrageenan forms strong, rigid, and brittle gels in the presence of potassium ions?
(A) Kappa-carrageenan

NODIA

15. Match List I with List II:
List I: (Additive Category)
P. Artificial Sweetener
Q. Natural Colour
R. Synthetic Colour
S. Flavour Enhancer
List II: (Specific Example)
I. Tartrazine
II. Monosodium glutamate
III. Aspartame
IV. Annatto
Choose the correct option:
(A) P-III, Q-IV, R-I, S-II
(B) P-III, Q-I, R-IV, S-II
(C) P-II, Q-IV, R-I, S-III
(D) P-IV, Q-III, R-II, S-I

16. While standardizing a fruit jelly recipe, you observe that the gel is too weak and tends to undergo syneresis. Assuming the pectin and sugar concentrations are optimal, what acidulant competency must be applied to correct the formulation?
(A) Increase the pH of the system by adding a buffering agent like sodium citrate.
(B) Add ascorbic acid specifically to act as a powerful antioxidant in the mixture.
(C) Decrease the pH to the optimal range of 2.8 - 3.2 by adding citric acid.
(D) Incorporate sodium bicarbonate to fully neutralize the natural fruit acids present.

17. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Buffering agents are added to food systems to maintain a constant pH despite the addition of small amounts of acids or bases.
Reason (R): Buffering agents typically consist of a weak acid and its conjugate base, which neutralize added acidic or basic compounds.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

18. Identify the incorrect pair of leavening agent and its characteristic property.
(A) Baking soda – Requires an external acidic ingredient to release carbon dioxide
(B) Baker's yeast – Produces carbon dioxide and ethanol through biological fermentation
(C) Double-acting baking powder – Contains both fast-acting and slow-acting leavening acids
(D) Single-acting baking powder – Releases most of its gas only upon heating

19. A food manufacturer wants to produce a dry mix for pancakes that will only release significant carbon dioxide when heated on a griddle, minimizing gas loss during batter resting. Which leavening acid should be prioritized in the formulation?
(A) Sodium aluminum sulfate (SAS)
(B) Monocalcium phosphate (MCP)
(C) Citric acid
(D) Potassium bitartrate (Cream of tartar)

20. What is the primary physical effect of incorporating calcium silicate into a highly hygroscopic powdered food product?
(A) It significantly lowers the raw water activity, preserving the dry food against rapid fungal mold growth.
(B) It enhances the chemical solubility of the powder when it is reconstituted in extremely cold water.
(C) It coats the powder particles and absorbs excess moisture, preventing the particles from clumping together.
(D) It creates an appealing glossy finish on the surface of the powder particles to improve overall visual appearance.

21. Which of the following food additives is primarily classified as a humectant?
(A) Glycerol
(B) Carnauba wax
(C) Silicon dioxide
(D) Sodium bicarbonate

22. Arrange the following steps in the standard sequential order for establishing the Acceptable Daily Intake (ADI) of a food additive:
1. Determination of the No-Observed-Adverse-Effect Level (NOAEL) in animal studies.
2. Identification of the hazard and toxicological testing.
3. Application of an uncertainty (safety) factor, typically 100.
4. Calculation of the final ADI expressed in mg

Downloaded from www.pdf.tube

under high tensile stress.

68. Read the given statements and select the correct option:
Statement I: According to FSSAI Schedule 1, food additives are categorized primarily based on their functional classes.
Statement II: A single food additive can only be listed under one functional class in Schedule 1, regardless of its multiple properties.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

69. All of the following are permitted synthetic food colours in India EXCEPT:
(A) Rhodamine B
(B) Brilliant Blue FCF
(C) Carmoisine
(D) Fast Green FCF

70. A seafood company wants to introduce a smart label on fresh fish packaging that visually changes colour as the fish spoils. This label responds to volatile basic nitrogen (TVB-N) compounds. This is a case of utilizing:
(A) Time-Temperature Indicators (TTI)
(B) Oxygen Scavengers
(C) Active Antimicrobial Packaging
(D) Freshness Indicators

71. Ethylene Vinyl Alcohol (EVOH) is widely used in multilayer flexible packaging films primarily because it provides an outstanding barrier against:
(A) Ultraviolet light
(B) Oxygen and other gases
(C) Water vapour
(D) Mechanical puncture

72. Identify the correct pair of a rigid packaging material and its defining characteristic.
(A) Glass bottles – Characterized by their high permeability to atmospheric gases
(B) Aluminium cans – Highly susceptible to physical rusting in humid storage environments
(C) Tin-free steel (TFS) cans – Coated with electrolytic chromium/chromium oxide
(D) Polycarbonate jars – Extremely low melting point, making them unsuitable for hot liquids

73. Consider the following statements regarding paper and paperboard packaging:
1. Kraft paper is manufactured using the sulfate pulping process, giving it high tensile strength.
2. Paper packaging is naturally impermeable to moisture and gases without any coatings.
3. Corrugated fiberboard consists of a fluted medium sandwiched between two flat linerboards.
4. Greaseproof paper is extensively hydrated during pulping to physically close the pores.

Which of the statements given above are correct?
(A) 1, 2, and 3
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 4

74. Bisphenol A (BPA) migration is primarily a food safety concern associated with which type of packaging material?
(A) Epoxy resin linings inside metal food cans
(B) Biodegradable polylactic acid (PLA) films
(C) Glass bottles and jars
(D) Low-density polyethylene (LDPE) shrink wraps

75. Match List I with List II:
List I: (Packaging Principle)
P. Protection
Q. Containment
R. Communication
S. Convenience
List II: (Practical Application)
I. A resealable zipper on a pouch of nuts
II. An opaque foil layer blocking UV light from cooking oil
III. A barcode and nutritional information panel
IV. A liquid-tight bottle holding exactly 1 litre of milk
Choose the correct option:
(A) P-II, Q-IV, R-III, S-I
(B) P-IV, Q-II, R-I, S-III
(C) P-II, Q-I, R-III, S-IV
(D) P-III, Q-IV, R-II, S-I

76. To establish an aseptic packaging line for milk, a technologist must ensure the sterilization of the packaging material before filling. Which chemical agent is most commonly evaluated for this specific competency?
(A) Sodium hypochlorite
(B) Hydrogen peroxide

NODIA

of potential temperature abuse during distribution.

30. Identify the incorrect statement regarding biodegradable and sustainable packaging materials.
(A) Polylactic acid (PLA) is a bio-based polymer derived from fermented plant starch.
(B) Biodegradable packaging materials degrade via the enzymatic action of microorganisms in the environment.
(C) All bioplastics, by definition, break down completely in household compost bins within 30 days.
(D) Polyhydroxyalkanoates (PHAs) are synthesized directly by microbes accumulating polyesters as energy reserves.

31. Which of the following packaging formats is specifically designed to withstand thermal processing temperatures up to 121°C for commercial sterilization?
(A) Aseptic cartons
(B) Expanded polystyrene (EPS) trays
(C) LDPE shrink wrap
(D) Retort pouches

32. Consider the following statements regarding aseptic packaging systems:
1. The food product and the packaging material are sterilized separately.
2. The filling and sealing operations are conducted in a sterile environment.
3. Hydrogen peroxide is commonly used for the chemical sterilization of the packaging material.
4. Aseptic packaging necessitates the food to be stored exclusively under refrigerated conditions.
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 1, 2, and 3
(D) 2, 3, and 4

33. Which of the following statements is correct regarding the migration of packaging material components into food?
(A) Migration only occurs when packaging materials are exposed to extreme temperatures exceeding 100°C in cooking.
(B) Global migration refers to the total mass of non-volatile substances transferred from the packaging to the food simulant.
(C) Specific migration limits (SML) are applied exclusively to highly inert natural glass packaging materials in retail.
(D) Fatty foods generally extract significantly fewer migrants from lipophilic plastic packaging than standard aqueous foods.

34. Match List I with List II:
List I: (Packaging Material Code/Abbreviation)
P. LDPE
Q. PP
R. EVOH
S. HDPE
List II: (Key Property/Application)
I. High melting point, suitable for hot-fill applications
II. Excellent gas barrier, highly sensitive to moisture
III. Excellent heat sealability, used in film blowing
IV. High tensile strength, opaque, used for milk jugs
Choose the correct option:
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-III, R-II, S-IV
(C) P-III, Q-I, R-IV, S-II
(D) P-II, Q-IV, R-I, S-III

35. Identify the incorrect statement regarding humectants in food processing.
(A) They promote the crystallization of sucrose in soft candies to increase firmness.
(B) They lower the water activity of a food system without physically removing moisture.
(C) Sorbitol and propylene glycol are common examples of food-grade humectants.
(D) They help maintain the softness of baked goods during extended shelf life.

36. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Butylated hydroxyanisole (BHA) is highly effective at terminating free radical chain reactions in oxidizing lipids.
Reason (R): BHA donates a hydrogen atom to lipid peroxyl radicals, forming a stable resonance-stabilized antioxidant radical.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the

Click Here to Buy book on Amazon

(C) Aspartame
(D) Acesulfame-K

85. In food chemistry, the "buffering capacity" of an additive system is defined as:
(A) The ability of a solution to resist changes in pH upon the addition of small amounts of strong acid or base.
(B) The total volume of food-grade acid required to completely neutralize a highly alkaline food product.
(C) The maximum permissible concentration of a buffering agent permitted under current FSSAI regulations.
(D) The thermodynamic rate at which a specific acidulant dissociates in a highly dilute aqueous solution.

86. Read the given statements and select the correct option:
Statement I: The primary metabolic products of yeast fermentation in bread making are lactic acid and acetic acid.
Statement II: The ethanol produced during yeast fermentation evaporates during the baking process.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

87. Which of the following combinations of properties makes beeswax and carnauba wax the most appropriate choices for use as glazing agents on confectionery products?
(A) High physical solubility in cold water and exceptionally low melting points.
(B) Edibility, inertness, and the ability to form a glossy, moisture-resistant film.
(C) Strong sweetening power combined with an intense natural botanical aroma.
(D) Ability to act as powerful oil-in-water emulsifiers and acidulants simultaneously.

88. A spice manufacturer faces a case where their garlic powder rapidly clumps and hardens in humid climates. To mitigate this without altering the flavour, which specific additive should be incorporated?
(A) Monosodium glutamate
(B) Ascorbic acid
(C) Silicon dioxide
(D) Sodium benzoate

89. Under FSSAI and Codex guidelines, what does the "carry-over principle" dictate?
(A) Additives from previous batches can be freely carried over into new production batches to save manufacturing costs.
(B) Packaging chemical migration limits are carried over across completely different food categories indiscriminately.
(C) Expired chemical food additives can be carried over and used in large quantities if they pass a simple sensory test.
(D) Additives not permitted in a final food can be present if legally added to raw ingredients within safe limits.

90. Identify the incorrect statement regarding the Codex General Standard for Food Additives (GSFA).
(A) It explicitly lists and regulates the usage levels of toxic heavy metal contaminants.
(B) It aims to be the single authoritative reference point for food additives in international trade.
(C) It includes provisions for the use of food additives in standardized and non-standardized foods.
(D) It evaluates additives based on risk assessments provided by the Joint FAO/WHO Expert Committee on Food Additives (JECFA).

91. Aluminium foil is highly valued in flexible food packaging laminates primarily because of its:
(A) High optical transparency and exceptional clarity that enhances the visual appeal of packaged foods.
(B) Absolute barrier properties against moisture, gases, and light at extremely low thicknesses.
(C) Inherent antimicrobial properties that actively kill pathogenic bacteria on contact with the foil.
(D) Complete biochemical biodegradability in standard soil and natural environmental conditions.

92. Consider the following statements regarding active packaging technologies:
1. Ethylene scavengers are used to delay the ripening and senescence of climacteric fruits.
2. Potassium permanganate is a common active compound used to oxidize ethylene gas.
3. Oxygen scavengers are highly recommended for packaging fresh produce to induce

Downloaded from www.pdf.tube

microwave applications.

(B) It offers excellent resistance to fatigue, allowing it to be used for "living hinges" on flip-top caps.

(C) It has a lower density than water, meaning it floats.

(D) It is exceptionally clear and provides an absolute, zero-permeability barrier to oxygen.

www.nodia.in

NODIA

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

99. All of the following are inherent limitations of standard, uncoated paper packaging EXCEPT:
(A) It is extremely difficult to print on or apply graphics to.
(B) It has very poor barrier properties against moisture and water vapour.
(C) It loses structural integrity and tensile strength when wet.
(D) It is highly permeable to oxygen and other gases.

100. A manufacturer of roasted peanuts is dealing with a case of rapid oxidative rancidity. To prolong shelf life, which combination of additive and packaging technology would be most effective?
(A) Adding calcium propionate and packaging in a highly flexible, oxygen-permeable plastic film.
(B) Adding sodium benzoate and vacuum packaging the product in a standard low-density polyethylene bag.
(C) Adding TBHQ to the oil and packaging in a nitrogen-flushed high-barrier metallized film.
(D) Adding a synthetic humectant and packaging the product in an active moisture-emitting internal sachet.

101. Sodium benzoate is most effective as a preservative in food systems where the pH is:
(A) Below 4.5
(B) Above 7.0
(C) Between 5.5 and 6.5
(D) Exactly 7.0

102. Identify the correct pair of an antimicrobial agent and its primary target organism in food systems.
(A) Natamycin – Inhibits Gram-negative bacterial pathogens
(B) Lysozyme – Inhibits common environmental yeast and molds
(C) Propionic acid – Specifically targets lactic acid bacteria
(D) Nisin – Gram-positive bacteria and bacterial spores

103. Consider the following statements regarding the mechanisms of food antioxidants:
1. Primary antioxidants function by terminating free radical chain reactions.
2. Ascorbic acid acts primarily as a secondary antioxidant by scavenging oxygen and chelating metals.
3. Chelating agents like EDTA act as primary antioxidants by directly donating hydrogen atoms to free radicals.
4. Tocopherols act as primary antioxidants in vegetable oils.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

104. When formulating a water-in-oil (W/O) emulsion such as butter or margarine, the most appropriate emulsifier to select would have a Hydrophilic-Lipophilic Balance (HLB) value in the range of:
(A) 8 to 18
(B) 12 to 15
(C) 3 to 6
(D) 15 to 20

105. Match List I with List II:
List I: (Gelling Agent)
P. Alginate
Q. Kappa-carrageenan
R. Low-methoxyl pectin
S. Iota-carrageenan
List II: (Specific Ion Requirement for Gelation)
I. Potassium ions
II. Calcium ions (strong interaction)
III. Calcium ions (necessary for gel network)
IV. Calcium ions (forms elastic gels)
Choose the correct option:
(A) P-III, Q-I, R-II, S-IV
(B) P-II, Q-I, R-III, S-IV
(C) P-III, Q-IV, R-II, S-I
(D) P-I, Q-II, R-IV, S-III

106. A beverage manufacturer wishes to replace synthetic Tartrazine with a natural yellow colourant while maintaining stability against light and low pH. Which competency in selecting natural colours leads to the best alternative?
(A) Annatto or Curcumin
(B) Beetroot extract (Betanin)
(C) Chlorophyll
(D) Anthocyanins

Click Here to Buy book on Amazon

anaerobic respiration.
4. Moisture absorbers help maintain the crispness of dry snacks.

(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

93. Which of the following statements is correct concerning Time-Temperature Indicators (TTI) used in smart packaging?
(A) They provide a visual record, usually a colour change, reflecting the accumulated temperature history of a product.
(B) They actively cool the food product inside the package if the ambient temperature rises above a critical target limit.
(C) They are legally mandated by FSSAI safety regulations for all shelf-stable dry packaged goods sold in India.
(D) They are solely used to measure and record the exact thermal cooking time of commercial retort pouches in factories.

94. Match List I with List II:
List I: (Biodegradable Polymer)
P. Polylactic acid (PLA)
Q. Polyhydroxyalkanoates (PHA)
R. Cellulose acetate
S. Thermoplastic starch
List II: (Source/Production Method)
I. Synthesized intracellularly by bacteria under stress conditions
II. Polymerized from monomers derived from fermented plant sugars
III. Modified structurally by the esterification of wood pulp
IV. Derived directly from maize or potato with the aid of plasticizers
Choose the correct option:
(A) P-II, Q-I, R-III, S-IV
(B) P-I, Q-II, R-IV, S-III
(C) P-II, Q-I, R-IV, S-III
(D) P-III, Q-IV, R-I, S-II

95. Identify the incorrect statement regarding the structure and function of a standard retort pouch.
(A) The outer layer is typically polyester (PET) for strength and printability.
(B) The middle layer is usually aluminium foil to provide a complete gas and light barrier.
(C) Cast Polypropylene (CPP) is preferred for the inner food-contact layer due to its high melting point and strong heat-sealability.
(D) The inner layer is usually High-Density Polyethylene (HDPE) because it melts easily to form a weak seal.

96. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): During migration testing of food packaging, chemical simulants such as 3% acetic acid or ethanol solutions are used instead of actual food.
Reason (R): Analyzing chemical migration in complex food matrices is analytically difficult, so standardized liquid simulants mimic the extractive properties of different food types.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

97. What is the fundamental definition of "active packaging" in food technology?
(A) Packaging designed to automatically physically expand as the total internal food volume increases.
(B) Packaging containing components that release or absorb substances into or from the food or its headspace.
(C) Packaging that simply monitors food conditions to communicate status updates during distribution.
(D) Packaging made strictly from highly reactive and conductive metals to optimize thermal processing.

98. Read the given statements and select the correct option:
Statement I: Intelligent packaging systems interact dynamically with the internal environment to alter the chemical composition of the food.
Statement II: Smart or intelligent packaging primarily focuses on sensing, monitoring, and communicating information about the product's status.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.

NODIA

(A) Silica sand (SiO2)
(B) Soda ash (Na2CO3)
(C) Limestone (CaCO3)
(D) Polyvinylidene chloride (PVDC)

115. In food packaging terminology, how is "headspace" defined?
(A) The unfilled volume remaining in a container after the product has been added and sealed.
(B) The precise physical thickness of the inner sealing polymer layer in a standard multilayer film.
(C) The designated physical area on the outer package label strictly reserved for nutritional facts.
(D) The microscopic pores distributed in a plastic film that allow uncontrolled passive gas exchange.

116. Read the given statements and select the correct option:
Statement I: A "hydrogen swell" in a metal can is caused by the microbial fermentation of sugars producing hydrogen gas.
Statement II: Acidic foods can react with the internal metal surface of an unlined can to produce hydrogen gas, causing the can to bulge.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

117. Which of the following represents the most appropriate reason for the widespread use of Polyethylene Terephthalate (PET) bottles over standard glass bottles for commercial carbonated soft drinks?
(A) PET is significantly lighter, shatter-resistant, and provides an adequate CO_2 barrier for the intended shelf life.
(B) PET is completely 100% impermeable to all atmospheric gases and vapours, whereas standard silica glass is highly permeable.
(C) PET actively scavenges trace dissolved oxygen molecules directly from the beverage headspace during ambient storage.
(D) PET bottles are significantly cheaper to chemically clean and reuse multiple times in a standard commercial closed-loop system.

118. A case study reveals that a batch of Modified Atmosphere Packaged (MAP) fresh pasta spoils rapidly due to mold growth, despite an initial gas flush of 100% CO_2. Which active packaging solution would best prevent this specific issue?
(A) Using a highly oxygen-permeable plastic film to allow the fresh pasta to respire actively.
(B) Adding an active chemical ethylene scavenger sachet directly inside the package headspace.
(C) Utilizing an electronic time-temperature indicator directly on the outer heat-sealed seam.
(D) Incorporating an active desiccant pad to significantly reduce the in-package relative humidity.

119. Under standard packaging definitions, what distinguishes a "compostable" plastic from a broadly "biodegradable" plastic?
(A) Compostable plastics break down exclusively in high-salinity marine environments through the direct biochemical action of salt-tolerant microorganisms.
(B) Compostable plastics break down at a specific rate under defined commercial composting conditions into water, CO_2, and biomass without toxic residue.
(C) Biodegradable plastics always break down into highly toxic synthetic microplastic residues, whereas certified compostable plastics yield zero toxic pollutants.
(D) Compostable plastics require continuous, intensive exposure to concentrated artificial UV light sources to initiate any thermal degradation pathways.

120. Identify the incorrect statement regarding the regulatory limits of migration in food packaging.
(A) The overall migration limit (OML) for plastics in contact with food is generally 60 mg/kg or 10 mg/dm².
(B) Simulants used for fatty foods commonly include n-heptane or vegetable oil.
(C) Distilled water is never used as a food simulant for any type of food product.
(D) Specific migration limits (SML) are tailored to the toxicological risk of individual chemical monomers or additives.

121. Sulphur dioxide functions in fruit juices not only as an antimicrobial preservative but also uniquely as an:
(A) Emulsifier
(B) Acidulant
(C) Artificial sweetener
(D) Antioxidant and anti-browning agent

Downloaded from www.pdf.tube

(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-I, S-II
(D) P-II, Q-IV, R-I, S-III

136. When evaluating the implementation of intelligent packaging (like TTIs or RFID tags) on a commercial scale, a food technologist must primarily assess which competency?
(A) The physical ability of the tag to completely sterilize the packaged food product inside using electromagnetic radiation.
(B) The direct biochemical nutritional enhancement the intelligent sensor provides to the food product during long storage.
(C) The cost-benefit ratio, ensuring the added cost of the sensor justifies the reduction in product waste or safety risk.
(D) The chemical ability of the tag to act as a primary high-barrier oxygen and water vapour blocker for the package.

137. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Edible coatings, such as those made from chitosan or zein, are increasingly used on fresh fruits and vegetables.
Reason (R): These coatings function as active packaging by creating a semi-permeable barrier that modifies the internal atmosphere and delays ripening.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

138. Identify the incorrect statement regarding the materials used in a typical retort pouch and their specific functions.
(A) Adhesive layer (Polyurethane) – Actively absorbs oxygen from the headspace
(B) Outer layer (PET) – Provides mechanical strength, puncture resistance, and printability
(C) Middle layer (Aluminium foil) – Provides an absolute barrier against light, oxygen, and moisture
(D) Inner layer (Cast Polypropylene) – Provides heat-sealability and food contact safety

139. In regulatory testing for the Overall Migration Limit (OML) of a plastic food container intended for microwave use, what conceptual condition must the test simulate?
(A) Only extreme sub-zero freezing temperatures for a continuous duration of exactly twenty-four hours.
(B) The most severe anticipated conditions of time and temperature during actual consumer use.
(C) Ambient room temperature for a period of ten days, completely regardless of the intended commercial use.
(D) Complete thermal incineration of the raw plastic material under highly controlled laboratory conditions.

140. What is the cause-effect relationship that dictates the use of opaque or UV-blocking packaging for fluid milk?
(A) Exposure to atmospheric UV light causes the non-enzymatic Maillard browning reaction of milk sugar to accelerate rapidly.
(B) Exposure to UV light rapidly degrades riboflavin (Vitamin B2) and induces light-struck, oxidized off-flavours.
(C) Opaque packaging material significantly increases the overall structural rigidity and tensile strength of the container.
(D) Continuous exposure to UV light causes the native liquid milk proteins to denature and coagulate almost immediately.

141. Sorbic acid is a widely used preservative, but in commercial applications, its salts (like potassium sorbate) are often preferred. Why?
(A) Potassium sorbate has significantly higher solubility in water than sorbic acid.
(B) Potassium sorbate has a much sweeter taste than sorbic acid.
(C) Potassium sorbate functions well at an alkaline pH, unlike sorbic acid.
(D) Potassium sorbate is naturally derived, whereas sorbic acid is strictly synthetic.

142. Arrange the operational steps of traditional thermal canning in the correct sequence:
1. Exhausting (removal of air from the headspace).
2. Filling the prepared food into cans.
3. Sealing (double seaming).

NODIA

128. Read the given statements and select the correct option:
Statement I: Citric acid is widely used in the food industry solely for its ability to lower the pH of foods.
Statement II: Citric acid also functions as a sequestrant, binding metal ions that could otherwise catalyze oxidative rancidity.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

129. All of the following are potential disadvantages or limitations of chemical leavening agents EXCEPT:
(A) They may leave an undesirable soapy or bitter aftertaste if improperly balanced.
(B) They act too slowly for use in quick breads or cakes, requiring hours of proofing.
(C) They cannot provide the distinctive fermented flavour profile associated with yeast breads.
(D) They can alter the pH of the baked product, affecting crumb colour.

130. A food company launches a multi-component snack containing dry crackers and high-moisture cheese cubes in the same package. The crackers quickly become soggy. Which packaging solution solves this case most effectively?
(A) Adding an active chemical oxygen scavenger sachet directly inside the sealed package to prevent spoilage.
(B) Replacing the external package film entirely with a significantly thicker layer of high-barrier EVOH polymer.
(C) Lowering the commercial storage and display temperature of the snack pack to an extreme sub-zero level of -18°C.
(D) Using an internal compartmentalized tray with a high-moisture-barrier film separating the two components.

131. Under food safety regulations, the maximum limits for heavy metals such as lead and arsenic in food-grade additives are strictly controlled. The general maximum limit for lead in most food additives is typically around:
(A) 2 to 10 mg/kg
(B) 50 to 100 mg/kg
(C) 0.01 mg/kg
(D) 500 mg/kg

132. Identify the correct pair regarding the Food Category System used in Codex GSFA.
(A) Category 02.0 – Meat and meat products
(B) Category 14.0 – Bakery products
(C) Category 01.0 – Dairy products and analogues
(D) Category 05.0 – Beverages, excluding dairy products

133. Consider the following functions related to the "communication" aspect of food packaging:
1. Displaying the FSSAI logo and license number.
2. Providing cooking instructions and recipes.
3. Absorbing excess purge (liquid) from raw meat.
4. Warning consumers about potential allergens like peanuts or soy.

Which of the functions given above are correct?
(A) 1, 2, and 3
(B) 1, 2, and 4
(C) 2, 3, and 4
(D) 1, 3, and 4

134. Which of the following is the most appropriate reason for using Tin-Free Steel (TFS) instead of conventional Tinplate for food cans?
(A) TFS is naturally immune to all forms of acid corrosion without requiring internal coatings.
(B) TFS cans can be hermetically sealed and sterilized in retorts without requiring a standard double seam.
(C) TFS provides a significantly brighter, more reflective external metallic surface than pure tin coatings.
(D) TFS offers a superior base for the uniform adhesion of protective organic enamels and anti-corrosive lacquers.

135. Match List I with List II:
List I: (Flexible Packaging Property)
P. Tensile strength
Q. Gas barrier property
R. Seal strength
S. Moisture barrier property
List II: (Test Method/Parameter)
I. Oxygen Transmission Rate (OTR)
II. Force required to break the material under tension
III. Water Vapour Transmission Rate (WVTR)
IV. Force required to peel apart a bonded seal
Choose the correct option:

Click Here to Buy book on Amazon

107. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Phosphoric acid is widely used as an acidulant in cola-type carbonated beverages.
Reason (R): It provides a sharper, more astringent tartness than citric acid and lowers the pH sufficiently to act synergistically with preservatives.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

108. Identify the incorrect pair regarding leavening acids and their reaction rates.
(A) Monocalcium phosphate (MCP) – Fast-acting, reacts rapidly at room temperature
(B) Sodium aluminum sulfate (SAS) – Fast-acting, reacts completely during batter mixing
(C) Sodium acid pyrophosphate (SAPP) – Available in various reaction rates (SAPP 28, SAPP 40)
(D) Dicalcium phosphate dihydrate (DCPD) – Slow-acting, requires heat to release acidity

109. In the context of risk assessment, the Acceptable Daily Intake (ADI) is conceptually calculated by:
(A) Dividing the NOAEL by a safety factor (typically 100).
(B) Multiplying the NOAEL by the safety factor (typically 100).
(C) Dividing the LD50 by the Maximum Residue Limit.
(D) Multiplying the daily food consumption by the specific migration limit.

110. What is the cause-effect relationship of adding magnesium carbonate or calcium silicate to table salt?
(A) It lowers the chemical pH of the table salt, significantly extending its natural shelf life.
(B) It significantly increases the active iodine content of the salt, preventing thyroid disorders.
(C) It coats the salt crystals, absorbing atmospheric moisture and preventing the salt from caking.
(D) It chemically bleaches the raw salt crystals, making them appear exceptionally stark white.

111. Under standard food regulations, steviol glycosides are classified functionally as:
(A) Highly concentrated artificial chemical flavour enhancers.
(B) Regulated synthetic organic and food-grade colorants.
(C) Traditional Class I food-grade microbiological preservatives.
(D) Non-nutritive, naturally derived intense sweeteners.

112. Arrange the following steps of double seaming in metal can operations in the correct sequential order:
1. Curling the can end over the can body flange.
2. Compression of the five layers of metal to form a tight hermetic seal.
3. First operation roll folding the end hook around the body hook.
4. Second operation roll flattening and tightening the folded seam.

(A) 1, 3, 4, 2
(B) 3, 1, 4, 2
(C) 1, 4, 3, 2
(D) 3, 4, 1, 2

113. Which of the following statements is correct regarding the application of Good Manufacturing Practice (GMP) in the use of food additives?
(A) GMP dictates that additives can be used to mask poor quality ingredients if the final product is physically safe for consumption.
(B) GMP requires the quantity of the additive added to food to be limited to the lowest possible level necessary to accomplish its desired effect.
(C) Under GMP principles, commercial food manufacturers are completely exempt from declaring any added chemical additives on the product label.
(D) GMP applies exclusively to synthetic chemical additives, while natural biological additives are subject to zero regulatory usage limits.

114. All of the following are principal components commonly used in the manufacture of commercial glass packaging EXCEPT:

NODIA

4. Thermal processing (retorting) and cooling.
(A) 2, 1, 3, 4
(B) 1, 2, 3, 4
(C) 2, 3, 1, 4
(D) 3, 2, 1, 4

143. Which of the following statements is correct regarding the synergistic effect between BHA and BHT?
(A) When combined, they physically form a robust molecular barrier on the surface of the lipid phase that blocks oxygen gas.
(B) BHA chemically neutralizes the potential toxic physiological effects of BHT when used together in high concentrations.
(C) BHT biochemically converts BHA molecules into a highly active secondary antioxidant chelator in aqueous solutions.
(D) Their combination provides a greater antioxidant effect than the sum of their individual effects, particularly in baked goods.

144. All of the following factors generally promote the stability of a food emulsion EXCEPT:
(A) Reducing the droplet size of the dispersed phase.
(B) Increasing the viscosity of the continuous phase.
(C) Subjecting the emulsion to repeated freeze-thaw cycles.
(D) Adding an appropriate emulsifier to lower interfacial tension.

145. What is the precise definition of "syneresis" in the context of food gels and stabilisers?
(A) The irreversible transition of a gel into a completely liquid state upon heating.
(B) The spontaneous exudation or weeping of liquid from a gel network.
(C) The rapid crystallization of sugars within a pectin gel.
(D) The enhancement of gel strength upon the addition of calcium ions.

146. Read the given statements and select the correct option:
Statement I: Flavour encapsulation involves trapping volatile flavour compounds within a matrix, such as maltodextrin or gum arabic.
Statement II: The primary purpose of flavour encapsulation is to accelerate the release of flavours immediately upon opening the package.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true, but Statement II is false.
(D) Statement I is false, but Statement II is true.

147. Which of the following is the most appropriate primary function of tartaric acid when used in combination with sodium bicarbonate in baking formulations?
(A) To provide the necessary hydrogen ions to react with the bicarbonate and release carbon dioxide.
(B) To act as an active biological dough conditioner to improve structural gluten strength in baking.
(C) To function as a powerful organic humectant and retain critical moisture in the final baked cake.
(D) To serve as an effective chemical antimicrobial preservative against bacterial rope formation in dough.

148. A manufacturer wants to formulate a soft-baked cookie that retains its chewy texture for six months. In this case, which humectant should be selected to optimally bind moisture while ensuring food safety?
(A) Sodium chloride
(B) Silicon dioxide
(C) Propylene glycol or Glycerol
(D) Butylated hydroxyanisole

149. The concept of applying an "uncertainty factor" (typically 100) when establishing the ADI for an additive is based on accounting for:
(A) Extrapolation from laboratory animal test data to humans and the genetic variations in sensitivity among human populations.
(B) Potential technical or human errors in precisely measuring and dispensing the additive during industrial food processing.
(C) The natural chemical degradation or breakdown of the active food additive compound over its commercial shelf life.
(D) Economic differences in the overall manufacturing cost of producing synthetic chemical versus natural botanical additives.

150. Identify the incorrect statement regarding the characteristics of Polypropylene (PP) as a packaging material.
(A) It has a higher melting point than HDPE, making it suitable for hot-filling and

NODIA

122. Consider the following statements regarding the use of nitrates and nitrites in cured meats:
1. Nitrites react with myoglobin to form nitrosylmyoglobin, creating the typical pink colour.
2. Nitrites are highly effective at inhibiting the outgrowth of Clostridium botulinum spores.
3. Excessive use of nitrites can lead to the formation of carcinogenic nitrosamines at high cooking temperatures.
4. Ascorbic acid is added to cured meats to inhibit the reduction of nitrite to nitric oxide.

Which of the statements given above are correct?
(A) 1, 2, and 4
(B) 2, 3, and 4
(C) 1, 2, and 3
(D) 1, 3, and 4

123. Which of the following statements is correct regarding primary and secondary antioxidants?
(A) Primary antioxidants are always synthetic chemical compounds, while secondary antioxidants are exclusively naturally occurring plant extracts.
(B) Primary antioxidants donate electrons or hydrogen atoms, while secondary antioxidants act by chelating metal ions or scavenging oxygen.
(C) Primary antioxidants function only at extremely low storage temperatures, whereas secondary antioxidants require thermal energy to activate.
(D) Secondary antioxidants actively regenerate primary antioxidants by chemically oxidizing them back to their highly active starting states.

124. Match List I with List II:
List I: (Emulsifier)
P. Lecithin
Q. Stearoyl lactylates
R. Polysorbate 80
S. Mono- and diglycerides
List II: (Common Food Application)
I. Dough conditioning and crumb softening in bread
II. Ice cream and frozen desserts (overrun control)
III. Margarine and bakery shortenings
IV. Chocolate manufacturing (viscosity reduction)
Choose the correct option:
(A) P-IV, Q-I, R-II, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-III, R-II, S-I
(D) P-III, Q-I, R-IV, S-II

125. Identify the incorrect statement regarding Xanthan gum.
(A) It loses its high viscosity almost completely when heated, making it unsuitable for hot sauces.
(B) It is an extracellular polysaccharide produced by the bacterium Xanthomonas campestris.
(C) It exhibits pseudoplastic (shear-thinning) flow behaviour, which is ideal for salad dressings.
(D) It is highly stable across a wide range of pH and salt concentrations.

126. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sucralose is widely used as a zero-calorie sweetener in baked goods.
Reason (R): Sucralose is manufactured by the selective chlorination of sucrose, making it exceptionally stable to high heat.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(A) is true but R is false.
(A) is false but R is true.

127. Which of the following best defines the function of "firming agents" as food additives?
(A) They are specialized chemical substances that make yeast-leavened bakery doughs expand significantly and uniformly during commercial baking operations.
(B) They are added as clarifying agents to physically precipitate and selectively remove residual suspended proteins in industrial wine and beer.
(C) They prevent the physical separation or weeping of free water and soluble liquid from a finished polysaccharide or protein gel network during storage.
(D) They interact chemically with cell wall pectic substances to maintain the raw crispness and physical tissue structure of fruits and vegetables.

Downloaded from www.pdf.tube

ANSWERS

1. (B) To purposely impart a technological effect in the manufacture or processing of food.
Food additives are substances intentionally added to food to perform specific technological functions, such as preserving quality, enhancing texture, or stabilizing emulsions during manufacturing, processing, preparation, treatment, packaging, transport, or storage. They do not include ingredients used for nutritional value or contaminants accidentally introduced during processing, ensuring food remains safe and consistent.

2. (B) 1, 2, and 4
Preservatives successfully extend food shelf life by preventing microbial growth and deterioration. Emulsifiers stabilize mixtures of immiscible liquids like oil and water, preventing phase separation. Firming agents maintain the crispness and structural integrity of plant tissues in fruits and vegetables. Sequestrants actually decrease fat oxidation by chelating transition metal ions that catalytically accelerate lipid rancidity.

3. (A) Their usage is restricted to specific food categories with defined maximum safe limits.
Class II chemical preservatives, such as benzoates, sorbates, and sulfites, are strictly regulated additives. Unlike Class I natural preservatives, their incorporation is permitted only within designated food categories up to legally mandated maximum limits. This protective oversight prevents excessive consumer exposure and toxicological issues while ensuring effective antimicrobial action in targeted food formulations.

4. (B) P-II, Q-IV, R-I, S-III
Sorbates inhibit yeasts and molds by disrupting cell membrane proton gradients. Sulfur dioxide prevents non-enzymatic browning and cleaves disulfide bonds in enzymes. Nitrites inhibit pathogenic spores in cured meats, notably Clostridium botulinum. Benzoates block the cellular uptake of essential amino acids in yeasts and molds under low pH conditions, acting as effective antimicrobial agents.

5. (A) Sodium benzoate is most effective as a preservative in low-acid foods with a pH above 6.0.
Sodium benzoate relies on its undissociated benzoic acid form to cross microbial cell membranes and exert antimicrobial action. This undissociated state is dominant and effective only in highly acidic food systems below pH four point five. In low-acid environments above pH six, the molecule dissociates into inactive ions, severely compromising its preservative efficiency.

6. (A) Both A and R are true and R is the correct explanation of A.
Curing meats with nitrates and nitrites serves a dual functional purpose in food processing. These compounds react chemically with meat pigments to produce nitrosylmyoglobin, which imparts and fixes the characteristic pink color. Simultaneously, they act as potent antimicrobials that strongly inhibit the germination of Clostridium botulinum spores, preventing deadly botulism food poisoning.

7. (B) A substance used to preserve food by retarding deterioration, rancidity, or discoloration due to oxidation.
Food antioxidants are specialized technological additives used to prolong product shelf life by delaying the onset of oxidative degradation. They actively inhibit reactions between atmospheric oxygen and sensitive food constituents like unsaturated lipids, pigments, and vitamins. This intervention prevents offensive oxidative rancidity, unpleasant off-odors, loss of nutritional value, and undesirable color changes during storage.

8. (C) Statement I is true, but Statement II is false.
Butylated hydroxyanisole and butylated hydroxytoluene are synthetic phenolic antioxidants engineered to withstand high temperatures, making them highly effective in baked and fried products. Conversely, tocopherols are natural, fat-soluble compounds possessing vitamin E activity. Because tocopherols are naturally occurring substances rather than synthetic additives, they are widely permitted in organic food processing systems.

NODIA

a stable pH is critical to preserve color, texture, and enzymatic stability.

86. (D) Statement I is false, but Statement II is true.
In bread making, Saccharomyces cerevisiae ferments sugars to produce carbon dioxide and ethanol as the primary metabolic products, not lactic or acetic acids. The carbon dioxide gas expands the gluten network to leaven the dough, while the co-produced ethanol volatilizes and evaporates completely during the high-temperature baking process in the oven.

87. (B) Edibility, inertness, and the ability to form a glossy, moisture-resistant film.
Beeswax and carnauba wax are highly valued as glazing agents due to their unique physical properties. These natural waxes are completely edible, chemically inert, and insoluble in water. When applied to confections or fruits, they form a thin, glossy, and highly moisture-resistant protective film that enhances visual appearance and retards water loss.

88. (C) Silicon dioxide
Garlic powder is highly hygroscopic and absorbs moisture from the air, leading to liquid bridging and undesirable clumping. Incorporating silicon dioxide resolves this issue. As an anticaking agent, it absorbs excess moisture and physically coats the food particles, reducing inter-particle friction and maintaining a free-flowing powder state without altering flavor or odor.

89. (D) Additives not permitted in a final food can be present if legally added to raw ingredients within safe limits.
The carry-over principle dictates that a food additive may be present in a final food product if it was legally permitted and incorporated into one of the raw ingredients. This presence is acceptable only if the additive level in the final food does not exceed the amount introduced by the raw ingredient under safe manufacturing practices.

90. (A) It explicitly lists and regulates the usage levels of toxic heavy metal contaminants.
The Codex General Standard for Food Additives is the authoritative global reference for regulating food additive permissions and maximum use levels. However, it does not regulate toxic heavy metal contaminants, which are governed by a separate Codex standard. GSFA focuses strictly on food additives in both standardized and non-standardized foods using JECFA risk assessments.

91. (B) Absolute barrier properties against moisture, gases, and light at extremely low thicknesses.
Aluminium foil is a critical material in flexible multilayer packaging laminates because, at thicknesses exceeding nine micrometers, it provides a total physical barrier. It blocks the transmission of moisture, atmospheric gases, and ultraviolet light. This absolute barrier performance protects sensitive food products from oxidation, structural degradation, and moisture loss during long-term ambient storage.

92. (A) 1, 2, and 4
Ethylene scavengers containing potassium permanganate are utilized to delay the ripening of climacteric fruits by oxidizing ethylene gas. Moisture absorbers prevent condensation, preserving snack crispness. However, oxygen scavengers are not recommended for fresh produce packaging; fresh produce requires oxygen for aerobic respiration, and excluding it completely would induce harmful anaerobic fermentation and spoilage.

93. (A) They provide a visual record, usually a colour change, reflecting the accumulated temperature history of a product.
Time-Temperature Indicators are smart packaging devices that monitor temperature exposure over time. They undergo a irreversible visual color change driven by chemical, enzymatic, or physical mechanisms, reflecting the accumulated temperature history of the product. This visual record allows distributors and consumers to easily detect temperature abuse along the cold chain.

94. (A) P-II, Q-I, R-III, S-IV
Polylactic acid is polymerized from lactic acid monomers derived from fermented plant sugars. Polyhydroxyalkanoates are synthesized intracellularly by bacteria under nutritional stress. Cellulose acetate is structurally modified from wood pulp via chemical esterification. Thermoplastic starch is produced directly from starch sources using plasticizers to disrupt the native crystalline granule structure.

Click Here to Buy book on Amazon

acting baking powders require thermal energy during baking to activate their second, slow-acting leavening acid component.

19. (A) Sodium aluminum sulfate (SAS)
Sodium aluminum sulfate is a slow-acting leavening acid that is highly insoluble in water at room temperature. It requires the high temperatures of baking, such as on a griddle, to hydrolyze and release the acidity needed to react with baking soda. This characteristics makes it ideal for minimizing gas loss during batter resting periods.

20. (C) Coats the powder particles and absorbs excess moisture, preventing the particles from clumping together.
Calcium silicate is a highly effective anticaking agent incorporated into hygroscopic food powders. It functions by absorbing large quantities of free water vapor from the internal package environment before the host food particles can. Additionally, it physically coats individual powder particles, reducing inter-particle friction and preventing them from forming hard clumps during storage.

21. (A) Glycerol
Glycerol is a highly effective, food-grade humectant structurally characterized by multiple hydrophilic hydroxyl groups. These functional groups form strong hydrogen bonds with water molecules, holding moisture within the food matrix and lowering overall water activity. This action prevents food from drying out and maintains a soft, desirable texture in intermediate-moisture products.

22. (A) 2, 1, 3, 4
Establishing the Acceptable Daily Intake begins with hazard identification and toxicological testing of the chemical. From this animal data, researchers identify the No-Observed-Adverse-Effect Level, which represents the highest safe dose. An uncertainty factor, typically one hundred, is then applied to account for interspecies differences. This calculation yields the final daily human intake value.

23. (B) Schedule 1 provides the list of permitted food additives, their applicable food categories, and their maximum usage levels.
Under the FSSAI regulatory framework, Schedule 1 serves as a comprehensive, legally binding directory for food additive compliance. It systematically details all permitted additives alongside the specific food categories where they are authorized for use. Furthermore, it defines the precise maximum permissible limits for each additive to guarantee food safety and prevent consumer toxicity.

24. (C) The additive can be used to disguise faulty raw materials or unhygienic manufacturing practices.
The Codex General Standard for Food Additives dictates that any permitted additive must present no consumer health risk and possess a clear technological justification. Crucially, additives must never be utilized to deceive consumers, mask faulty raw materials, or disguise unhygienic manufacturing practices. Additives must always be used at the lowest level necessary to achieve their purpose.

25. (D) The physical holding of the product in a defined space to allow handling and transportation without spillage.
Containment is a fundamental physical function of food packaging, focusing on keeping the product secure within a designated space. It prevents raw product loss, scattering, or spillage from the point of manufacture through distribution, retail, and final consumption. This primary physical containment makes the handling, storage, and transportation of liquid, powdered, or granular foods practically feasible.

NODIA

26. (C) Statement I is true, but Statement II is false.
Glass is an exceptional packaging material because its dense amorphous structure is completely impermeable to atmospheric gases and moisture vapors. However, metal packaging is highly resistant to thermal processing and does not suffer from thermal shock. Instead, glass is the material highly susceptible to thermal shock and fracturing when subjected to rapid temperature changes during pasteurization.

27. (B) It provides an excellent barrier against carbon dioxide permeation and is highly lightweight.
Polyethylene Terephthalate is highly preferred for carbonated beverage packaging due to its unique combination of properties. It possesses excellent gas barrier properties, which successfully prevents carbon dioxide from escaping and keeps beverages carbonated. Additionally, its lightweight nature, high optical clarity, shatter resistance, and high tensile strength make it a highly practical alternative to heavy glass.

66. (A) Both A and R are true and R is the correct explanation of A.
Humectants are crucial in formulating intermediate moisture foods because they possess high water-binding capacities. By forming strong hydrogen bonds with water molecules, they significantly lower the water activity of the food system. This restriction of free water effectively prevents microbial proliferation and chemical degradation while maintaining a soft, moist, and palatable product texture.

67. (A) The maximum permitted amount of a given specific substance authorized to migrate from the packaging material into food or food simulants.
The Specific Migration Limit is a strict regulatory parameter defined in food contact material laws. It represents the maximum allowable concentration of a specific, chemically identified monomer, additive, or plasticizer that can transfer from the packaging material into food or food simulants. This limit is established based on toxicological safety evaluations of individual chemical substances.

68. (C) Statement I is true, but Statement II is false.
Under FSSAI Schedule 1, food additives are systematically grouped and categorized according to their primary functional classes. However, because many food additives are multi-functional substances, a single additive can be listed under multiple functional classes. For instance, sulfur dioxide is categorized as both a chemical preservative and an effective antioxidant.

69. (A) Rhodamine B
Brilliant Blue FCF, Carmoisine, and Fast Green FCF are synthetic food colors permitted under strict regulatory limits by FSSAI. In contrast, Rhodamine B is a highly toxic synthetic dye that is completely banned from use in any food products. It is classified as an industrial colorant and potential carcinogen, posing severe health hazards.

70. (D) Freshness Indicators
Smart labels that visually change color in response to volatile basic nitrogen compounds are classified as freshness indicators. As seafood undergoes microbial spoilage, it releases volatile basic nitrogen gases that react chemically with the indicator dye on the label. This reaction triggers a visible color shift, directly communicating the real-time quality and safety of the food.

71. (B) Oxygen and other gases
Ethylene Vinyl Alcohol copolymer is widely incorporated into flexible multilayer films due to its exceptionally low permeability to oxygen and other atmospheric gases. This superior gas barrier performance protects oxygen-sensitive foods from lipid oxidation and microbial spoilage. However, EVOH is highly hydrophilic and loses its gas barrier properties if exposed directly to high moisture.

72. (C) Tin-free steel (TFS) cans – Coated with electrolytic chromium/chromium oxide
Tin-free steel cans are rigid metal packaging containers manufactured by depositing a ultra-thin layer of electrolytic chromium and chromium oxide onto a steel base. This structure provides excellent adhesion for protective organic lacquers and enamels. Unlike tinplate, TFS does not use tin, making it a highly cost-effective and acid-resistant material for canned foods.

73. (B) 1, 3, and 4
Kraft paper is produced using the sulfate pulping process, which preserves fibers to yield high tensile strength. Corrugated fiberboard utilizes a fluted medium between flat linerboards for structural cushioning. Greaseproof paper undergoes intense refining to close pores. Crucially, uncoated paper is naturally highly permeable to moisture and gases, requiring laminations or coatings.

74. (A) Epoxy resin linings inside metal food cans
Bisphenol A is a synthetic chemical compound used primarily in the manufacture of polycarbonate plastics and epoxy resins. The internal protective linings of metal food and beverage cans often utilize epoxy coatings to prevent acid corrosion. The migration of trace BPA from these linings into packaged foods represents a significant toxicological and regulatory concern.

75. (A) P-II, Q-IV, R-III, S-I
The protection principle is illustrated by an opaque foil layer blocking harmful ultraviolet light. Containment is shown by a liquid-tight bottle holding a specific volume of milk. Communication involves displaying barcodes and nutritional panels to inform consumers. Convenience is represented by user-friendly packaging features, such as a resealable zipper on a pouch.

Downloaded from www.pdf.tube

37. (A) A substance applied to the external surface of a food to impart a shiny appearance or provide a protective coating.
Glazing agents are specialized food additives applied directly to the exterior surfaces of foods, particularly confectionery, fresh fruits, and bakery items. They function to impart an appealing, glossy sheen and provide a protective physical barrier. This protective coating helps minimize moisture loss, prevents sticking, and shields the food from minor environmental contamination during distribution.

38. (C) Statement I is true, but Statement II is false.
Saccharomyces cerevisiae is a living organism that ferments sugars to produce carbon dioxide and ethanol, rising dough under anaerobic conditions. In contrast, chemical leavening agents rely on acid-base reactions that proceed much faster than biological fermentation. Chemical leavening releases gas rapidly, eliminating the need for the prolonged proofing times required by yeast-leavened dough systems.

39. (B) Potassium bromate
Tartrazine, sodium benzoate, and ascorbic acid are widely permitted food additives when utilized within regulatory limits. In contrast, potassium bromate, once a popular dough conditioner, has been banned or severely restricted in numerous jurisdictions, including India and the European Union. This regulatory action is due to its classification as a potential human carcinogen.

40. (C) Calcium propionate
Calcium propionate is the most effective preservative for commercial bread production. It specifically targets and inhibits the growth of molds and the endospore-forming bacterium Bacillus mesentericus, which causes undesirable rope formation in bread crumbs. Importantly, calcium propionate does not interfere with the fermentation activity of baker's yeast under normal dough processing conditions.

41. (D) Soybeans
Lecithin is a naturally occurring mixture of polar phospholipids widely utilized as a food emulsifier. While present in eggs and sunflower seeds, its primary commercial source is the refining process of crude soybean oil. Extracting lecithin from soybeans is highly cost-effective and yields large volumes of high-quality emulsifier suitable for stabilizing diverse food emulsions.

42. (A) Xanthan gum – Exhibits extreme shear-thinning (pseudoplastic) behaviour
Xanthan gum is unique for its extreme pseudoplastic or shear-thinning rheological behavior, where its viscosity drops rapidly under physical shear and recovers instantly when the shear is removed. Conversely, gum arabic requires very high concentrations to display viscosity. Agar-agar is insoluble in cold water, and locust bean gum requires synergistic interactions to form strong gels.

43. (B) 2, 3, and 4
Sucralose, saccharin, and steviol glycosides possess robust chemical structures that resist thermal degradation, making them highly stable under high-temperature baking conditions. In contrast, aspartame is a dipeptide methyl ester that is highly heat-sensitive. When heated, aspartame undergoes rapid hydrolysis, losing its sweetening power completely, making it unsuitable for baked food applications.

NODIA

44. (B) Citric acid
Citric acid is an extremely versatile organic tri-carboxylic acid widely selected for fruit beverages. It acts as an acidulant to impart a pleasing tart flavor, functions as a pH regulator to optimize beverage stability, and serves as an effective chelating agent. Its chelating ability binds trace transition metals, preventing them from catalyzing undesirable oxidative browning.

45. (A) P-IV, Q-III, R-I, S-II
The International Numbering System categorizes food additives logically into distinct numerical series. The one hundred series is assigned to food colors, while the two hundred series designates chemical preservatives. Antioxidants are categorized within the three hundred series, and food thickeners, stabilizers, and emulsifiers are systematically grouped under the four hundred series for clear regulatory identification.

46. (C) High oxygen permeability combined with a good moisture barrier.
Packaging fresh red meat requires a film with high oxygen permeability to maintain the bright cherry-red color of oxymyoglobin on the surface of the meat. Simultaneously, the packaging film must provide an effective moisture barrier to prevent product dehydration and weight loss. Creating a vacuum or excluding oxygen would turn the myoglobin into dull purple deoxymyoglobin.

28. (B) Ethylene Vinyl Alcohol (EVOH)
Ethylene Vinyl Alcohol is widely utilized in the core of coextruded multilayer films because of its exceptionally high barrier resistance against oxygen transmission. This specialized polymer prevents atmospheric oxygen from penetrating the package, thereby protecting highly sensitive food components from oxidative rancidity, sensory degradation, and aerobic microbial growth. It is superior to standard polyethylenes in barrier performance.

29. (A) To scavenge oxygen from the package headspace, thereby preventing lipid oxidation and aerobic spoilage.
Active packaging utilizing iron powder sachets operates on the chemical principle of oxidation. The iron powder reacts with trapped headspace oxygen, converting it into iron oxides and reducing package oxygen levels to less than zero point one percent. This scavenging action successfully prevents lipid oxidation, off-flavors, color degradation, and the growth of aerobic spoilage microorganisms.

30. (C) All bioplastics, by definition, break down completely in household compost bins within 30 days.
Polylactic acid and polyhydroxyalkanoates are prominent sustainable polymers synthesized from renewable agricultural or microbial sources. However, not all bioplastics are compostable, and many certified compostable polymers require highly controlled, high-temperature industrial composting facilities to degrade. They do not automatically or rapidly break down in standard, low-temperature household backyard compost bins within a short timeframe.

31. (D) Retort pouches
Retort pouches are advanced flexible laminated structures engineered specifically to withstand the intense heat and pressure of commercial retort sterilization, typically reaching temperatures up to one hundred and twenty-one degrees Celsius. These pouches combine plastic and aluminum layers to provide an absolute barrier, allowing shelf-stable foods to be processed and stored safely without refrigeration.

32. (C) 1, 2, and 3
Aseptic packaging relies on sterilizing the food product and the packaging material independently before bringing them together. The filling and hermetic sealing operations must occur inside a highly sterile chamber. Hydrogen peroxide is the industry standard chemical sterilant used for treating the packaging material. Crucially, aseptic foods are shelf-stable and do not require refrigerated storage.

33. (B) Global migration refers to the total mass of non-volatile substances transferred from the packaging to the food simulant.
Global migration is a regulatory parameter measuring the total quantity of all non-volatile chemical substances that transfer from a packaging material into a food simulant under standardized test conditions. It assesses the overall inertness of the plastic. Conversely, specific migration limits focus strictly on individual, identifiable substances of known toxicological concern to ensure consumer safety.

34. (A) P-III, Q-I, R-II, S-IV
Low-density polyethylene offers high flexibility and excellent heat sealability, making it ideal for blown films. Polypropylene possesses a high melting point, suitable for hot-fill applications. Ethylene vinyl alcohol serves as an exceptional gas barrier but is highly sensitive to moisture. High-density polyethylene exhibits high tensile strength and opacity, often utilized for blow-molded milk containers.

35. (A) They promote the crystallization of sucrose in soft candies to increase firmness.
Humectants are additives used in food systems to lower water activity and retain moisture, maintaining softness and pliability in items like baked goods. Crucially, they act to inhibit or control the crystallization of sugars like sucrose in candies, rather than promoting it. This control ensures the confection retains a smooth, soft, and desirable texture over time.

36. (A) Both A and R are true and R is the correct explanation of A.
Butylated hydroxyanisole is a highly effective primary antioxidant that interrupts the self-sustaining propagation loop of lipid autoxidation. It operates by donating a hydrogen atom from its phenolic hydroxyl group to highly reactive lipid peroxyl radicals. This reaction yields a stable, resonance-stabilized antioxidant radical that is unable to abstract hydrogen from unsaturated fatty acids, terminating the chain reaction.

Click Here to Buy book on Amazon

permissions. Under this system, if an additive is permitted in a general parent category, its permission is automatically carried over and applied to all its sub-categories unless a specific exclusion is explicitly stated.

57. (D) The printed nutritional facts panel and allergen declarations.
The communication function of food packaging involves conveying critical product information directly to the consumer and distributors. The printed nutritional facts panel, ingredient lists, safety warnings, and allergen declarations serve as prime examples of this principle. These features ensure regulatory compliance and help consumers make informed, safe dietary choices when purchasing products.

58. (A) Ascorbate accelerates the reduction of nitrite to nitric oxide, improving colour formation and reducing residual nitrite levels.
Sodium ascorbate is added during meat curing to act as a powerful reducing agent. It accelerates the chemical reduction of nitrite to nitric oxide, which is the active compound required to bind myoglobin and form the characteristic pink color. This fast reaction optimizes color development and significantly minimizes the level of undesirable residual nitrites.

59. (B) Synergism
When two or more antioxidants are applied together and produce a total protective effect greater than the mathematical sum of their individual effects, the phenomenon is termed synergism. In lipid systems, combining antioxidants like BHA and BHT exploits different mechanisms of radical scavenging, resulting in superior protection against oxidative rancidity and extending shelf life.

60. (B) They possess a very high Hydrophilic-Lipophilic Balance (HLB) value, making them excellent for oil-in-water (O/W) emulsions.
Mono- and diglycerides constitute the largest group of commercial food emulsifiers, often synthesized via transesterification of triglycerides. They are highly effective at preventing starch retrogradation and staling. However, they possess low Hydrophilic-Lipophilic Balance values, typically between three and six, making them lipophilic and highly suited for stabilizing water-in-oil emulsions, not oil-in-water emulsions.

61. (A) Kappa-carrageenan
Kappa-carrageenan is a sulfated galactan extracted from red seaweeds that exhibits a strong, specific sensitivity to potassium ions. The addition of potassium promotes the folding of polymer chains into tight double helices, which subsequently aggregate. This molecular alignment results in the formation of strong, rigid, and brittle gels characterized by high syneresis.

62. (B) 1, 3, and 4
FSSAI regulations restrict permitted synthetic food colors, such as Tartrazine, Sunset Yellow, and Ponceau 4R, to a maximum concentration of one hundred milligrams per kilogram in final products. Any food containing these colors must carry a clear label declaration. Importantly, synthetic colors are strictly prohibited in fresh, raw, or unprocessed produce to prevent deception.

63. (D) They are obtained exclusively through physical, microbiological, or enzymatic processes from material of plant or animal origin.
Natural flavors are defined by regulatory bodies as flavoring substances obtained exclusively via physical extraction, microbiological fermentation, or enzymatic processes from materials of plant or animal origin. They must not contain any synthetically manufactured chemical mimics. These natural flavorings are used to safely restore or enhance the authentic sensory profile of processed food systems.

64. (A) P-III, Q-IV, R-I, S-II
Phosphoric acid provides a sharp, astringent taste ideal for cola-type carbonated beverages. Tartaric acid is key in baking powders and grape-flavored foods. Acetic acid is the primary acidulant used in pickles and condiments for preservation and flavor. Malic acid offers a smooth, lingering tartness perfectly suited for apple-flavored juices and hard candies.

65. (B) It provides a double-acting leavening effect, releasing gas both during mixing and baking.
Baking soda is a single-acting chemical leaven that releases carbon dioxide immediately upon contacting water and an acidic ingredient. It does not possess a double-acting mechanism. If used without sufficient acid, it leaves an unreacted alkaline residue of sodium carbonate, imparting an unpleasant, bitter soapy taste and altering the crumb color.

Downloaded from www.pdf.tube

9. (D) Ascorbyl palmitate
Butylated hydroxyanisole, butylated hydroxytoluene, and tertiary butylhydroquinone represent purely synthetic phenolic antioxidants extensively utilized in the food industry. In contrast, ascorbyl palmitate is a fat-soluble ester synthesized from natural ascorbic acid and palmitic acid. It is classified as a semi-synthetic or naturally-derived antioxidant compound rather than a strictly synthetic chemical additive.

10. (A) Lecithin
Mayonnaise is a classic oil-in-water emulsion that is thermodynamically unstable and prone to rapid phase separation. Incorporating lecithin, an amphiphilic phospholipid, resolves this by positioning its hydrophilic head in the water phase and lipophilic tail in the oil phase. This alignment lowers interfacial tension and creates a protective barrier around droplets, stabilizing the emulsion.

11. (B) Polysorbates
Polysorbates are synthetic, non-ionic surfactants structurally defined as polyoxyethylene sorbitan esters of fatty acids. These compounds possess a high hydrophilic-lipophilic balance, rendering them highly soluble in water and highly effective at stabilizing oil-in-water emulsions. Other emulsifying agents, such as lecithin or mono- and diglycerides, display significantly different chemical structures and lipid solubilities.

12. (B) Guar gum – Endosperm of Cyamopsis tetragonoloba seeds
Guar gum is a natural galactomannan polysaccharide extracted specifically from the ground endosperm of Cyamopsis tetragonoloba seeds. In contrast, pectin is sourced primarily from terrestrial land plants like citrus peels or apple pomace. Alginate is extracted from brown seaweed species, whereas carrageenan is isolated from the cell walls of specific marine red algae.

13. (A) 1 and 2
High-methoxyl pectin requires high sugar concentrations and low pH to form a gel network by promoting hydrophobic interactions. Low-methoxyl pectin relies instead on divalent calcium ions to bridge carboxyl groups, forming a gel regardless of sugar content. Kappa-carrageenan produces firm, brittle gels with potassium, while guar gum acts primarily as a thickener, not a gelling agent.

14. (C) To exploit synergistic interactions yielding superior viscosity at lower total polymer concentrations.
Combining specific hydrocolloid thickeners often triggers highly beneficial synergistic interactions, where the combined molecular network produces significantly greater viscosity or gel strength than each gum used individually. This physical phenomenon allows food technologists to achieve target rheological properties using a much lower overall concentration of polymers, reducing production costs and preventing unwanted off-flavors.

15. (A) P-III, Q-IV, R-I, S-II
Aspartame is a widely used low-calorie artificial sweetener. Annatto is a natural colorant extracted from plant seeds, providing yellow-orange hues. Tartrazine is a popular synthetic azo dye used to impart a vibrant yellow color. Monosodium glutamate is a classic flavor enhancer that stimulates umami taste receptors to improve the overall palatability of savory foods.

16. (C) Decrease the pH to the optimal range of 2.8 - 3.2 by adding citric acid.
High-methoxyl pectin requires an acidic environment, typically between pH two point eight and three point two, to form a stable gel. Lowering the pH suppresses the negative charge on carboxyl groups, reducing electrostatic repulsion and allowing pectin chains to associate via hydrogen bonding. Adding citric acid achieves this necessary pH reduction, preventing syneresis.

17. (A) Both A and R are true and R is the correct explanation of A.
Buffering agents are added to food systems to stabilize and maintain a highly constant pH. They typically consist of a weak acid and its conjugate base, such as citric acid and sodium citrate. This conjugate pair effectively neutralizes small amounts of added hydrogen or hydroxyl ions, preventing significant pH shifts that could ruin food color, texture, or stability.

18. (D) Single-acting baking powder – Releases most of its gas only upon heating
Single-acting baking powders utilize highly soluble acidulants that react almost completely with baking soda at room temperature immediately upon contact with moisture. Consequently, they release the vast majority of their carbon dioxide gas during the mixing stage. In contrast, double-

76. (B) Hydrogen peroxide
Sterilizing packaging materials in commercial aseptic lines is most commonly achieved using hydrogen peroxide. At concentrations between thirty and thirty-five percent, combined with thermal energy, hydrogen peroxide acts as a rapid, highly effective sterilant. It destroys bacterial endospores on the packaging surface and subsequently decomposes completely into harmless water and oxygen vapors.

77. (A) Both A and R are true and R is the correct explanation of A.
Polysorbates are frequently added to ice cream formulations as highly effective emulsifiers. During the freezing and churning process, they displace milk proteins from the fat globule surface, promoting controlled fat emulsion destabilization. This partial coalescence of fat is essential to trap air bubbles, creating a stable foam structure that ensures smooth texture and proper overrun.

78. (C) Beta-tocopherol – Acts as a pro-oxidant in all food systems
Tocopherols are natural fat-soluble antioxidants with varying biological and chemical potencies. Alpha-tocopherol possesses the highest in-vivo vitamin E activity, whereas delta-tocopherol displays the highest in-vitro antioxidant efficiency. Beta-tocopherol does not act as a pro-oxidant in all systems; rather, it functions as a moderate antioxidant depending on concentration and lipid composition.

79. (D) Scavenge free radicals and interrupt the propagation phase of lipid auto-oxidation.
Synthetic phenolic antioxidants like BHT and TBHQ operate by donating hydrogen atoms to highly reactive lipid peroxyl and alkoxyl radicals. This chemical donation converts the reactive radicals into stable molecules and produces a resonance-stabilized antioxidant radical. This intervention effectively halts the self-sustaining propagation phase of lipid autoxidation, delaying rancidity.

80. (C) It lowers the interfacial tension between immiscible liquids, stabilizing the emulsion.
Emulsifiers contain both hydrophilic and lipophilic regions within their molecular structure. When added to immiscible liquids, they migrate to the interface and form organized micellar structures. This behavior significantly reduces the interfacial tension between the oil and water phases, preventing droplet coalescence and stabilizing the emulsion against rapid phase separation.

81. (B) Low pH (< 3.5) and high soluble solids content (sugar $> 55\%$)
High-methoxyl pectin requires highly specific conditions to form a stable gel network. The pH must be low, typically below three point five, to minimize the negative charge on carboxyl groups. Simultaneously, a high soluble solids content, such as sugar exceeding fifty-five percent, is mandatory to bind water molecules and force pectin chains to associate.

82. (B) 3, 1, 2, 4
A standard aseptic packaging operation follows a precise sequence to guarantee sterility. First, the food product is subjected to independent thermal processing. Separately, the packaging material is sterilized, often using hydrogen peroxide. The sterile product is then filled into the sterile container, which is hermetically sealed within a highly controlled sterile environment.

83. (A) It is a cold-water-soluble polysaccharide that functions primarily as a highly effective thickener.
Guar gum is a natural galactomannan polysaccharide that hydrates rapidly in cold water to yield high viscosity. It functions primarily as a highly effective thickener and stabilizer in diverse food systems. Unlike gelling agents, guar gum does not form independent gels on its own and does not require divalent calcium ions to hydrate.

84. (C) Aspartame
Sucralose, saccharin, and acesulfame-K are non-nutritive intense sweeteners that possess high thermal stability, allowing them to withstand standard commercial baking temperatures. Conversely, aspartame is a methyl ester dipeptide that is highly heat-sensitive. When subjected to baking heat, it undergoes rapid chemical hydrolysis, losing its sweet taste and failing to function as a sweetener.

85. (A) The ability of a solution to resist changes in pH upon the addition of small amounts of strong acid or base.
Buffering capacity refers to the quantitative ability of an aqueous food system to resist shifts in pH when small amounts of acid or base are added. This property is governed by the presence of a weak acid and its conjugate base. Maintaining

Click Here to Buy book on Amazon

47. (A) Both A and R are true and R is the correct explanation of A.
Moisture absorbers containing silica gel or calcium oxide are widely used inside food packages to control internal humidity. They function by actively sequestering free water vapor, which prevents moisture condensation on the inner surface of the film. This dry headspace environment successfully retards the growth of molds and maintains the desired crispness of low-moisture foods.

48. (C) Polypropylene (PP) – Polymerized chains of ester monomers
Glass is manufactured from silica sand, soda ash, and limestone, while tinplate consists of low-carbon steel coated with tin. Cellophane is produced from regenerated wood pulp cellulose. However, polypropylene is a synthetic polyolefin polymer composed of polymerized propylene monomers, not ester monomers. Polyester, not polypropylene, is constructed from repeating ester linkage monomers.

49. (B) Global migration assesses the total non-volatile transfer to food, whereas specific migration tracks the transfer of one specific identifiable chemical.
Global migration tests assess the overall inertness of a packaging material by measuring the cumulative quantity of all non-volatile chemical substances transferring into a food simulant. Conversely, specific migration testing focuses on tracking and quantifying the transfer of a single, highly specific chemical substance, such as a monomer or plasticizer, that has known toxicological limits.

50. (D) The internal pressure inside the pouch exceeds the external pressure of the cooling water, which can cause the pouch seals to burst.
During the cooling phase of retort pouch thermal processing, the steam inside the retort condenses rapidly, causing a sudden drop in chamber pressure. However, the internal temperature and pressure inside the sealed pouch remain high. Without applying external counter-pressure, this extreme pressure differential will cause the flexible pouch seals to burst or fail catastrophically.

51. (A) Silver nanoparticles
Silver nanoparticles are frequently incorporated into active packaging films due to their broad-spectrum, highly effective antimicrobial properties. They function by continuously releasing silver ions that disrupt microbial cell membranes, inactivate cellular enzymes, and inhibit DNA replication of pathogenic and spoilage organisms. This technology extends food shelf life by actively suppressing microbial growth on the food surface.

52. (A) 2, 4, 1, 4, 3
A standard retort pouch is constructed from a high-performance multilayer laminate. The outermost layer is polyester, which provides structural strength and printability. This is bonded via a polyurethane adhesive to a middle layer of aluminum foil, which acts as a total barrier. Another adhesive layer bonds the foil to the innermost food-contact layer of cast polypropylene.

53. (A) LDPE has a higher degree of polymer chain branching than HDPE, making it more flexible.
Low-density polyethylene possesses a highly branched polymer chain structure, which prevents the molecules from packing tightly. This structural arrangement makes LDPE highly flexible and clear. In contrast, high-density polyethylene has minimal branching, allowing close molecular packing that results in a highly crystalline, stiff, strong, and opaque material with a higher melting point.

54. (D) It possesses a low tare weight relative to its volume.
Glass is highly valued in food packaging because it is chemically inert, impermeable to gases, and easily hermetically sealed. However, a major disadvantage of glass is its high tare weight relative to its volume, which significantly increases transportation costs and fuel consumption compared to lightweight alternatives like plastic or aluminum containers.

55. (B) No-Observed-Adverse-Effect Level
In the scientific risk assessment of food additives, NOAEL stands for the No-Observed-Adverse-Effect Level. It represents the highest exposure level or dose of a substance, determined through toxicological animal studies, at which no statistically significant adverse alterations in morphology, functional capacity, growth, or lifespan are detected in the treated subjects.

56. (C) Statement I is true, but Statement II is false.
The Codex General Standard for Food Additives utilizes a highly structured, hierarchical food category system to organize and assign additive

95. (D) The inner layer is usually High-Density Polyethylene (HDPE) because it melts easily to form a weak seal.
A standard retort pouch consists of a high-strength outer polyester layer for printability, a middle aluminum foil layer for gas barrier protection, and an inner cast polypropylene layer. Cast polypropylene is chosen for its high melting point, excellent chemical resistance, and ability to form strong hermetic heat seals that withstand high-pressure sterilization.

96. (A) Both A and R are true and R is the correct explanation of A.
In migration testing, direct chemical analysis of packaging compounds within complex food matrices is analytically difficult. Therefore, standardized food simulants, such as three percent acetic acid or ethanol solutions, are used. These liquid simulants successfully mimic the extractive properties of acidic, aqueous, or alcoholic foods, providing a reliable and reproducible method to evaluate safety.

97. (B) Packaging containing components that release or absorb substances into or from the food or its headspace.
Active packaging is defined as a technology that dynamically interacts with the packaged food or its internal headspace. It incorporates specialized components that actively release beneficial substances, such as antimicrobials or antioxidants, or absorb undesirable compounds, like oxygen, moisture, or ethylene. This interaction helps preserve food quality and extend product shelf life.

98. (D) Statement I is false, but Statement II is true.
Intelligent packaging systems do not alter the chemical composition of food; instead, they focus on sensing, monitoring, and communicating real-time information about the product's environmental status. Active packaging is the specific technology that dynamically interacts with the food or headspace to chemically modify the package atmosphere and extend product shelf life.

99. (A) It is extremely difficult to print on or apply graphics to.
Uncoated paper packaging is highly valued for its biodegradable nature and its excellent printability, making it very easy to apply high-quality graphics and labels. However, its major limitations include poor barrier properties against moisture, water vapor, and atmospheric gases, as well as a severe loss of tensile strength and structural integrity when wet.

100. (C) Adding TBHQ to the oil and packaging in a nitrogen-flushed high-barrier metallized film.
Roasted peanuts contain high levels of unsaturated lipids that are highly prone to rapid oxidative rancidity. To effectively prolong shelf life, incorporating a powerful oil-soluble synthetic antioxidant like TBHQ is necessary. This formulation should be combined with packaging in a nitrogen-flushed, high-barrier metallized film to exclude oxygen and block light, preventing lipid oxidation.

101. (A) Below 4.5
Sodium benzoate functions as an effective antimicrobial preservative only when converted into its undissociated benzoic acid form. This chemical conversion occurs predominantly in highly acidic food environments, specifically at a pH below four point five. In neutral or low-acid foods, the molecule dissociates into inactive ions, which cannot penetrate microbial cell membranes to inhibit growth.

102. (D) Nisin – Gram-positive bacteria and bacterial spores
Nisin is a natural bacteriocin that specifically targets Gram-positive bacteria and effectively inhibits the outgrowth of bacterial endospores. Conversely, natamycin is an antifungal agent that selectively targets yeasts and molds, having no antibacterial activity. Lysozyme targets Gram-positive bacterial cell walls, and propionic acid primarily acts to inhibit mold growth in bakery products.

103. (A) 1, 2, and 4
Primary antioxidants, including tocopherols, function by donating hydrogen atoms to free radicals, terminating the lipid oxidation chain reaction. Secondary antioxidants like ascorbic acid act as oxygen scavengers or synergists. Crucially, chelating agents like EDTA do not act as primary antioxidants; they function as secondary antioxidants by sequestering transition metals that catalyze free radical formation.

104. (C) 3 to 6
Formulating a water-in-oil emulsion like butter or margarine requires a lipophilic surfactant

Downloaded from www.pdf.tube

peanuts. What is the regulatory consequence of this omission?
(A) It is acceptable since peanuts are widely considered a spice or condiment in bakery items.
(B) It violates allergen labelling rules, making the product misbranded.
(C) It is entirely acceptable if the finished product undergoes high-temperature baking.
(D) It is considered a minor administrative violation with no product recall implications.

24. Identify the correct pair of a claim category and its specific example.
(A) Disease Risk Reduction Claim - "Improves memory and intelligence"
(B) Nutrient Comparative Claim - "Contains Calcium"
(C) Nutrient Content Claim - "Rich in Vitamin C"
(D) Health Claim - "Low in Sodium"

25. What is the direct cause of product recalls when an ingredient like whey powder is inadvertently excluded from the ingredient list of a dairy-free dessert?
(A) Violation of net quantity standards
(B) Improper date marking
(C) Exceeding allowable limits for food additives
(D) Undeclared presence of a major milk allergen

26. All of the following foods require a mandatory declaration of major food allergens on their labels, EXCEPT:
(A) Refined soy oil
(B) Packaged mixed tree nuts
(C) Whole wheat bread
(D) Processed cheese

27. A food manufacturer formulates a beverage with 4.5g of sugar per 100ml. The manufacturer wishes to label it as "Low Sugar". According to standard FSSAI regulations for liquids, is this claim valid?
(A) Yes, because it is below 5g per 100ml.
(B) No, because "Low Sugar" requires less than 2.5g per 100ml in liquids.
(C) Yes, because any reduction from original formulation allows the claim.
(D) No, because "Low Sugar" claims are completely banned on beverages.

28. Identify the correct statement regarding Country of Origin labelling under FSSAI.
(A) It is mandatory only for meat and dairy products.
(B) It must be declared on all imported food products.
(C) It is optional if the product is repacked in India.
(D) It replaces the name and address of the importer.

29. Identify the incorrect pair regarding food ingredients and their allergen status.
(A) MSG (Monosodium Glutamate) - Major food allergen requiring bold highlighting
(B) Sulphite in concentrations of 10 mg/kg or more - Mandatory declaration required
(C) Casein - Milk allergen
(D) Albumin - Egg allergen

30. What is the most appropriate action for a retailer when a food product in their inventory crosses its "Best Before" date?
(A) The product must be immediately destroyed and disposed of as it is highly toxic to consumers.
(B) The product must be shipped back to the manufacturer for complete industrial reprocessing.
(C) The product cannot be sold as it is non-compliant for sale.
(D) The product can be sold to consumers at a highly discounted price if it is re-labeled.

NODIA

31. Which standard digital system is primarily used globally and in India to facilitate rapid identification and traceability of food products at retail points?
(A) RFID implants
(B) Blockchain ledger codes
(C) Proprietary alphanumeric ciphers
(D) GS1 Barcodes (GTIN)

32. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): The implementation of a robust traceability system allows a Food Business Operator to selectively recall only specific affected batches of a product.
Reason (R): Traceability systems link the finished product's batch number back to specific raw material lots, processing dates, and distribution

114. (D) Polyvinylidene chloride (PVDC)
Commercial glass containers are manufactured by melting inorganic raw materials at high temperatures. The principal components include silica sand as the glass former, soda ash as a flux to lower the melting point, and limestone as a stabilizer to improve chemical durability. Polyvinylidene chloride is a synthetic plastic polymer, not an ingredient in glass.

115. (A) The unfilled volume remaining in a container after the product has been added and sealed.
Headspace in food packaging refers to the unfilled volume or gas space remaining inside a sealed container above the food product. The composition and volume of this gas headspace are critical, as removing oxygen from this area via vacuum or gas flushing is key to preventing lipid oxidation and aerobic microbial spoilage.

116. (D) Statement I is false, but Statement II is true.
A hydrogen swell in a metal food can is not caused by microbial fermentation. Instead, it is a chemical reaction where highly acidic foods react directly with the internal metal surface of an unlined or damaged can, releasing hydrogen gas. This chemical accumulation of hydrogen gas inside the sealed container causes the can to bulge.

117. (A) PET is significantly lighter, shatter-resistant, and provides an adequate CO_2 barrier for the intended shelf life.
Polyethylene Terephthalate is preferred over glass for carbonated soft drinks because it offers significant physical advantages. PET is exceptionally lightweight, reducing transport costs, and is highly shatter-resistant, improving retail safety. Crucially, it provides a highly effective barrier against carbon dioxide permeation, maintaining beverage carbonation and quality throughout its designated shelf life.

118. (D) Incorporating an active desiccant pad to significantly reduce the in-package relative humidity.
Fresh pasta has high water activity, which creates an ideal environment for mold growth inside modified atmosphere packages. Even with carbon dioxide flushing, accumulated moisture condensation can trigger rapid fungal spoilage. Incorporating an active desiccant pad resolves this by absorbing excess free moisture and lowering humidity within the package headspace, preventing mold.

119. (B) Compostable plastics break down at a specific rate under defined commercial composting conditions into water, CO_2, and biomass without toxic residue.
Biodegradable plastics break down through the action of microorganisms, but without a specified timeframe or environment. In contrast, compostable plastics must biodegrade at a defined rate under controlled industrial composting conditions. This process converts the polymer completely into carbon dioxide, water, and nutrient-rich biomass, leaving absolutely no toxic chemical residues or persistent microplastics behind.

120. (C) Distilled water is never used as a food simulant for any type of food product.
Regulatory migration testing utilizes food simulants to evaluate packaging safety. The overall migration limit is set to control total chemical transfer. While fatty foods are simulated using vegetable oil or n-heptane, distilled water is indeed widely used as a standard food simulant representing aqueous, non-acidic foods. Specific migration limits target individual toxic monomers.

121. (D) Antioxidant and anti-browning agent
Sulfur dioxide is a multi-functional additive in fruit juices. Beyond acting as an effective antimicrobial preservative against yeasts and bacteria, it functions as a powerful antioxidant and anti-browning agent. It prevents both enzymatic and non-enzymatic browning reactions by scavenging oxygen, reducing quinones back to phenols, and cleaving critical enzyme disulfide bonds.

122. (C) 1, 2, and 3
Nitrites are added to cured meats to produce nitrosylmyoglobin, fixing the characteristic pink color, and to strongly inhibit Clostridium botulinum spore germination. However, excess nitrites can form carcinogenic nitrosamines under high heat. Ascorbic acid is added to accelerate the reduction of nitrite to nitric oxide, thereby inhibiting the formation of nitrosamines.

123. (B) Primary antioxidants donate electrons or hydrogen atoms, while secondary antioxidants act by chelating metal ions or scavenging oxygen.
Primary antioxidants function by directly donating electrons or hydrogen atoms to free radicals, converting them into stable molecules and terminating the lipid oxidation chain reaction. In contrast, secondary antioxidants prevent or

Click Here to Buy book on Amazon

to stabilize the water droplets dispersed in oil. Emulsifying agents with a low Hydrophilic-Lipophilic Balance value, specifically in the range of three to six, are hydrophobic and ideal for this purpose. Higher HLB values stabilize oil-in-water emulsions instead.

105. (A) P-III, Q-I, R-II, S-IV
Alginate relies on strong interactions with calcium ions to form a rigid gel via the egg-box model. Kappa-carrageenan requires potassium ions to form firm, brittle gels. Low-methoxyl pectin necessitates calcium ions to bridge carboxyl groups, forming a stable gel. Iota-carrageenan interacts with calcium ions to form soft, highly elastic, and syneresis-free gels.

106. (A) Annatto or Curcumin
Annatto and curcumin are excellent natural yellow colorants that can successfully replace synthetic Tartrazine. Curcumin, extracted from turmeric, provides a vibrant yellow hue and exhibits high stability in low-pH beverage formulations. Annatto offers yellow-orange shades with good light stability. Other options like betanin or anthocyanins produce red, pink, or purple hues, not yellow.

107. (A) Both A and R are true and R is the correct explanation of A.
Phosphoric acid is widely utilized as an inorganic acidulant in cola beverages. It provides a unique, sharp, and astringent tartness that complements the heavy cola flavor profile better than organic citric acid. Additionally, it lowers the product pH efficiently, creating an acidic environment that enhances the antimicrobial activity of preservatives like sodium benzoate.

108. (B) Sodium aluminum sulfate (SAS) – Fast-acting, reacts completely during batter mixing
Monocalcium phosphate is a fast-acting leavening acid that reacts quickly with baking soda at room temperature. Conversely, sodium aluminum sulfate is a slow-acting acidulant that is highly insoluble in cold water. It requires baking heat to hydrolyze and release acid, making it react during the baking stage rather than during batter mixing.

109. (A) Dividing the NOAEL by a safety factor (typically 100).
The Acceptable Daily Intake is a toxicological metric that represents the amount of a food additive that can be consumed daily over a lifetime without appreciable health risk. Mathematically, it is calculated by dividing the No-Observed-Adverse-Effect Level, derived from animal studies, by an uncertainty or safety factor, which is typically one hundred.

110. (C) It coats the salt crystals, absorbing atmospheric moisture and preventing the salt from caking.
Adding magnesium carbonate or calcium silicate to table salt prevents the salt from clumping and hardening under humid conditions. These chemical compounds function as anticaking agents by coating the individual salt crystals. They actively absorb ambient atmospheric moisture before the salt can, ensuring the product remains free-flowing and easy to dispense.

111. (D) Non-nutritive, naturally derived intense sweeteners.
Steviol glycosides are high-intensity sweeteners extracted from the leaves of the Stevia rebaudiana plant. Under food regulations, they are classified as non-nutritive, naturally-derived sweeteners because they provide intense sweetness up to three hundred times that of sucrose while contributing zero calories to the final food formulation during consumption.

NODIA

112. (A) 1, 3, 4, 2
Double seaming is a crucial metal canning operation to form a hermetic seal. The process begins with curling the can end over the body flange. The first operation roll then folds the end hook around the body hook. Next, the second operation roll flattens and tightens the fold, achieving final compression of the five metal layers.

113. (B) GMP requires the quantity of the additive added to food to be limited to the lowest possible level necessary to accomplish its desired effect.
Good Manufacturing Practice in food additive usage dictates that the amount of an additive incorporated into food must be restricted to the lowest possible concentration required to achieve the intended technological effect. Additives must never be used to cover up poor raw materials, unhygienic practices, or to deceive consumers in any way.

133. (B) 1, 2, and 4
The communication function of food packaging involves displaying essential information for consumers and regulatory compliance. This includes showing the FSSAI logo and license number, providing clear cooking instructions, and warning about potential allergens like peanuts. Absorbing excess liquid from raw meat is an active protection function, not a communication or information-sharing function.

134. (D) TFS offers a superior base for the uniform adhesion of protective organic enamels and anti-corrosive lacquers.
Tin-free steel is a popular alternative to tinplate in the manufacture of food cans. It consists of steel coated with chromium and chromium oxide, which provides a highly polar surface. This surface offers outstanding adhesion for protective organic lacquers and enamels, ensuring the metal resists acid corrosion from food contents.

135. (A) P-II, Q-I, R-IV, S-III
Tensile strength is evaluated by measuring the force required to break a material under tension. Gas barrier properties are assessed via the Oxygen Transmission Rate. Seal strength is determined by the force needed to peel apart a bonded seal. Moisture barrier properties are quantified using the Water Vapour Transmission Rate.

136. (C) The cost-benefit ratio, ensuring the added cost of the sensor justifies the reduction in product waste or safety risk.
Implementing intelligent packaging on a commercial scale requires evaluating technological and economic viability. A primary consideration is the cost-benefit ratio, as smart indicators or RFID tags increase total packaging costs. The added expense must be economically justified by improvements in food safety, quality monitoring, shelf life tracking, and reduction of food waste.

137. (A) Both A and R are true and R is the correct explanation of A.
Edible coatings made from natural polymers like chitosan or zein are applied directly to the surface of fresh fruits and vegetables. These coatings act as active packaging by creating a semi-permeable physical barrier. This barrier restricts oxygen uptake and carbon dioxide loss, modifying the internal atmosphere of the fruit to slow respiration and delay ripening.

138. (A) Adhesive layer (Polyurethane) – Actively absorbs oxygen from the headspace
In a retort pouch, the outer polyester layer provides strength, the aluminum foil middle layer blocks gases and light, and the cast polypropylene inner layer provides heat-sealability. The polyurethane adhesive layers function strictly to bond these primary layers together; they do not actively absorb oxygen or possess other active chemical packaging functions.

139. (B) The most severe anticipated conditions of time and temperature during actual consumer use.
Testing for the Overall Migration Limit of a plastic container intended for microwave use must replicate the most severe conditions of time and temperature anticipated during actual consumer heating. Using standardized food simulants, this high-temperature extraction testing ensures the plastic remains chemically stable and does not release excessive compounds into food under intense heat.

140. (B) Exposure to UV light rapidly degrades riboflavin (Vitamin B2) and induces light-struck, oxidized off-flavours.
Fluid milk is highly sensitive to light exposure, which degrades essential nutrients and quality. Ultraviolet light penetrates transparent containers and photo-oxidizes riboflavin. This reaction acts as a photosensitizer, catalyzing the rapid oxidation of milk proteins and lipids, which produces undesirable light-struck off-flavors. Opaque or UV-blocking packaging successfully prevents this degradation.

141. (A) Potassium sorbate has significantly higher solubility in water than sorbic acid.
Sorbic acid is a highly effective antifungal preservative but exhibits low solubility in aqueous solutions, which limits its direct application in many foods. Consequently, its salt form, potassium sorbate, is preferred in commercial processing because it has exceptionally high water solubility, allowing uniform distribution throughout the food matrix before releasing active sorbic acid.

NODIA

142. (A) 2, 1, 3, 4
Traditional thermal canning follows a strict operational sequence to ensure commercial sterility. The process begins with filling prepared food into metal cans. Next, exhausting is performed to remove air from the headspace. The

cans are then hermetically sealed using a double seaming machine, followed by thermal processing in a retort and rapid cooling.

143. (D) Their combination provides a greater antioxidant effect than the sum of their individual effects, particularly in baked goods.
Combining BHA and BHT in lipid food formulations exploits a highly beneficial synergistic effect. Their co-presence allows them to terminate free radical chain reactions more effectively than either compound could individually, particularly in fat-containing baked goods. This synergistic action provides superior protection against oxidative rancidity while minimizing the required concentration of each synthetic additive.

144. (C) Subjecting the emulsion to repeated freeze-thaw cycles.
Emulsion stability is enhanced by reducing dispersed droplet size, increasing continuous phase viscosity, and adding emulsifiers to lower interfacial tension. Conversely, subjecting an emulsion to repeated freeze-thaw cycles promotes instability. The formation of ice crystals disrupts the protective emulsifier film, forcing dispersed droplets to coalesce and leading to rapid, irreversible phase separation.

145. (B) The spontaneous exudation or weeping of liquid from a gel network.
Syneresis refers to the spontaneous contraction of a gel network, which forces the entrapment of water out and results in the exudation or weeping of liquid onto the gel surface. This phenomenon occurs when polymer chains associate too tightly, reducing the interstitial spaces available to hold water, and is a common quality defect in starch, pectin, and gelatin gels.

146. (C) Statement I is true, but Statement II is false.
Flavour encapsulation involves trapping volatile flavor compounds inside a protective carrier matrix, such as maltodextrin or gum arabic, using spray drying or coacervation. The primary purpose is to protect these highly sensitive, volatile compounds from thermal degradation, oxidation, and evaporation during processing and storage, rather than to accelerate their immediate release.

147. (A) To provide the necessary hydrogen ions to react with the bicarbonate and release carbon dioxide.
Tartaric acid is a fast-acting organic acidulant used in baking formulations. When hydrated, it quickly dissociates to provide hydrogen ions that react chemically with sodium bicarbonate. This acid-base reaction releases carbon dioxide gas, which expands the batter and leavens the product during the initial mixing stage, ensuring proper volume and texture.

148. (C) Propylene glycol or Glycerol
To formulate soft-baked cookies that remain chewy, a food technologist must incorporate a highly effective, safe humectant. Propylene glycol or glycerol are ideal choices due to their multiple hydroxyl groups, which bind free water molecules via hydrogen bonding. This action lowers water activity and prevents moisture loss, keeping the cookie soft without promoting mold growth.

149. (A) Extrapolation from laboratory animal test data to humans and the genetic variations in sensitivity among human populations.
Applying an uncertainty or safety factor, typically one hundred, is a standard toxicological practice when calculating the Acceptable Daily Intake. This factor accounts for two primary variables: extrapolating toxicological data from laboratory animals to humans (a factor of ten) and accounting for the natural genetic variations in sensitivity within the human population (another factor of ten).

150. (D) It is exceptionally clear and provides an absolute, zero-permeability barrier to oxygen.
Polypropylene is a versatile polyolefin plastic characterized by a high melting point, excellent fatigue resistance for living hinges, and low density. While PP provides a highly effective barrier against moisture, it is not exceptionally clear like PET, nor does it provide an absolute, zero-permeability barrier to oxygen. It requires barrier coatings for oxygen-sensitive foods.

Downloaded from www.pdf.tube

CHAPTER 19

Labelling, Storage, Transportation and Street Foods

NODIA

1. Under FSSAI regulations, which of the following mandatory declarations must be displayed on a packaged food product containing a genetically modified ingredient?
(A) A circular logo with 'GM' printed in bright red color on the front label
(B) The text "Contains Genetically Modified Ingredients" on the front label
(C) A square logo with 'GM' printed in bright green color on the front label
(D) An asterisk mark placed next to the ingredient name in the list

2. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): All packaged foods in India are required to bear a vegetarian or non-vegetarian logo on the principal display panel.
Reason (R): This regulation helps consumers easily identify the dietary nature of the food product and respect their cultural and religious preferences.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

3. Which of the following statements regarding the formatting of nutritional information on food labels is incorrect according to FSSAI guidelines?
(A) Vitamins and minerals must be declared as a percentage of daily value, omitting metric weights.
(B) Nutritional information must be declared per 100g or 100ml or per single consumption serving of the product.
(C) Energy value from the product must be declared specifically in kilocalories (kcal) or in kilojoules (kJ).
(D) The total amount of energy, protein, carbohydrates, and fats must be clearly specified on the panel.

4. Match the labelling components in List I with their standard definitions in List II:
List I: (Component)
P. Principal Display Panel
Q. Batch Number
R. Date of Manufacture
S. Best Before
List II: (Definition)
I. The date on which the food becomes the product as described
II. The period during which the food remains fully marketable and retains specific qualities
III. A mark of identification by which the food can be traced in manufacture and distribution
IV. The part of the label most likely to be displayed or examined under customary conditions
(A) P-III, Q-IV, R-I, S-II
(B) P-IV, Q-III, R-II, S-I
(C) P-IV, Q-III, R-I, S-II
(D) P-I, Q-II, R-III, S-IV

5. What is the precise definition of "Serving Size" as per FSSAI Food Safety and Standards (Labelling and Display) Regulations?
(A) An amount of food customarily consumed per eating occasion, expressed in metric units
(B) The maximum amount of food a person is allowed to eat in one day for a healthy diet
(C) The entire net quantity of the packaged food regardless of consumption occasion
(D) The minimum amount of food required to provide 10% of the Recommended Dietary Allowance (RDA)

6. Consider the following declarations on a food label:
I. FSSAI logo and license number

retard oxidation through alternative mechanisms, such as scavenging dissolved oxygen, absorbing ultraviolet radiation, or chelating transition metal ions that catalyze free radical formation.

124. (A) P-IV, Q-I, R-II, S-III
Lecithin is used in chocolate manufacturing to reduce viscosity and control flow properties. Stearoyl lactylates act as dough conditioners and crumb softeners in bread. Polysorbate eighty controls fat destabilization and overrun in ice cream. Mono- and diglycerides are lipophilic emulsifiers widely utilized to stabilize margarine and commercial bakery shortenings.

125. (A) It loses its high viscosity almost completely when heated, making it unsuitable for hot sauces.
Xanthan gum is an extracellular polysaccharide produced by Xanthomonas campestris that displays excellent pseudoplastic flow behavior. Crucially, xanthan gum is highly stable across a wide range of temperatures, maintaining its viscosity when heated. This thermal stability, combined with pH and salt resistance, makes it highly suited for stabilizing hot sauces and dressings.

126. (A) Both A and R are true and R is the correct explanation of A.
Sucralose is widely utilized as a non-caloric sweetener in baked goods because it possesses outstanding thermal stability. It is manufactured by the selective, multi-step chlorination of sucrose, replacing three hydroxyl groups with chlorine atoms. This chemical modification creates a robust molecular structure that does not break down or lose its sweetness under high-temperature baking conditions.

127. (D) They interact chemically with cell wall pectic substances to maintain the raw crispness and physical tissue structure of fruits and vegetables.
Firming agents are food additives that act to preserve or restore the structural integrity of processed fruits and vegetables. They function by releasing divalent cations, such as calcium, which chemically cross-link with the carboxyl groups of cell wall pectic substances. This cross-linking strengthens the pectin network, maintaining crispness and preventing tissue softening during thermal processing.

128. (D) Statement I is false, but Statement II is true.
Citric acid is not used in the food industry solely for its ability to lower pH. Beyond its primary role as an organic acidulant, citric acid functions effectively as a secondary antioxidant sequestrant. It binds and chelates transition metal ions like iron and copper, preventing them from catalyzing lipid oxidation and enzymatic browning reactions.

129. (B) They act too slowly for use in quick breads or cakes, requiring hours of proofing.
Chemical leavening agents react rapidly through acid-base chemistry, releasing gas within minutes, which makes them ideal for quick breads and cakes without requiring proofing. However, their limitations include potentially leaving a soapy or bitter taste if unbalanced, altering product pH and crumb color, and failing to provide the complex fermented flavor profile of yeast.

130. (D) Using an internal compartmentalized tray with a high-moisture-barrier film separating the two components.
In multi-component snacks containing high-moisture cheese and dry crackers, water vapor naturally migrates from high to low water activity areas, making crackers soggy. Utilizing an internal compartmentalized tray sealed with a high-moisture-barrier film physically blocks this moisture migration. This design successfully preserves the crispness of the crackers and the quality of the cheese.

131. (A) 2 to 10 mg/kg
Food safety regulations enforce strict limits on heavy metal contaminants in food-grade additives to prevent bioaccumulation and chronic toxicity. The maximum permissible limit for lead in most standard food additives is tightly controlled, generally falling within the range of two to ten milligrams per kilogram, ensuring the additive remains safe for human consumption.

132. (C) Category 01.0 – Dairy products and analogues
The Codex General Standard for Food Additives utilizes a standardized numerical Food Category System to organize additive permissions. In this system, Category zero one point zero is assigned to dairy products and analogues. Other categories, such as bakery products or meat, are assigned entirely different numerical codes, ensuring precise regulatory application across food types.

Click Here to Buy book on Amazon

(D) To help consumers compare nutritional content between different brands

16. Which of the following date markings strictly indicates the date after which the food product is unsafe for consumption?
(A) Best Before Date
(B) Date of Manufacture
(C) Use By Date
(D) Date of Packaging

17. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): Even if an allergen is present in a food product only through cross-contact during manufacturing, it must be declared on the label.
Reason (R): Allergens can cause severe anaphylactic reactions in susceptible individuals even in minute trace amounts.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

18. Which of the following statements about health and nutrition claims on food labels is incorrect?
(A) Health claims must be fully substantiated by robust, globally recognized scientific evidence.
(B) Non-addition of sodium claims can only be made if no sodium salt has been added to the food.
(C) Nutrient comparative claims must always be made against a reference food of the same category.
(D) Claims that a food cures a human disease are allowed if it has medicinal herbs.

19. Match the major food allergens in List I with their common food products in List II:
List I: (Allergen)
P. Gluten
Q. Crustaceans
R. Tree nuts
S. Soybeans
List II: (Food Product)
I. Tofu
II. Macadamia
III. Prawns
IV. Rye
(A) P-IV, Q-III, R-II, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-II, R-III, S-I
(D) P-III, Q-IV, R-I, S-II

20. How is "Best Before" date defined in the context of food safety and labelling?
(A) The specific date after which the food must be completely discarded due to microbial hazards
(B) The exact calendar date on which the raw food was harvested, caught, or slaughtered
(C) The period the food remains marketable and retains its specific qualities
(D) The final date up to which the food item can be legally sold to customers at full price

21. Consider the following statements regarding the declaration of date marking on food labels:
I. Products with a shelf life of less than 7 days must declare the day, month, and year of manufacture.
II. Products with a shelf life of more than 3 months must declare the month and year of manufacture.
III. "Use By" date is mandatory for all spices and condiments.
IV. Alcoholic beverages containing more than 10% alcohol by volume are exempt from "Best Before" date marking.
Which of the above statements are correct under FSSAI rules?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

22. Given below are two statements:
Statement I: A "Low Fat" claim can only be made if the solid food contains less than 3g of fat per 100g.
Statement II: A "Sugar-Free" claim requires the product to have absolute zero carbohydrates.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

23. A consumer purchases a packaged bakery product that contains peanuts as a major ingredient. However, the label only mentions "spices and condiments" without highlighting

NODIA

II. Net quantity
III. Name and address of the manufacturer
IV. Brand ambassador's signature
Which of the above declarations are mandatory on packaged food labels as per FSSAI guidelines?
(A) II, III, and IV only
(B) I, III, and IV only
(C) I, II, III, and IV
(D) I, II, and III only

7. Given below are two statements:
Statement I: The declaration of trans fat content is mandatory on the nutritional panel of all packaged foods containing fats or oils.
Statement II: A product can claim to be "Trans Fat Free" if it contains less than 0.2g of trans fat per 100g or 100ml of the food.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

8. Arrange the following components in the correct sequence as they must generally appear when listing ingredients on a food label.
1. Food additives
2. Major ingredients
3. Spices and condiments
4. Added water
(A) 2, 4, 3, 1
(B) 2, 3, 1, 4
(C) 1, 2, 3, 4
(D) 4, 3, 2, 1

9. Identify the correct pair of nutritional parameter and its standard unit of declaration on an Indian food label.
(A) Total Carbohydrates - milligrams (mg)
(B) Sodium - grams (g)
(C) Cholesterol - micrograms (μg)
(D) Energy - kilocalories (kcal)

10. What is the primary reason the FSSAI mandates the declaration of added sugar separately from total carbohydrates on a food label?
(A) To help consumers identify and restrict empty calories linked to diseases
(B) To distinguish between cane sugar and beet sugar in the manufacturing process of the food
(C) To provide a standard metric for calculating the overall moisture and dry matter content
(D) To ensure that all of the sweetening agents utilized in the formulation are non-synthetic

11. All of the following food categories are generally exempt from mandatory nutritional labelling under FSSAI regulations, EXCEPT:
(A) Raw agricultural commodities like fresh fruits and vegetables
(B) Fortified edible vegetable oils
(C) Single ingredient products like packaged drinking water
(D) Herbs, spices, and condiments

12. A packaged food contains 15g of protein per 100g. If the reference Recommended Dietary Allowance (RDA) for protein is 50g per day, and a serving size is 50g, what is the percentage of daily value of protein provided by one serving?
(A) 15%
(B) 20%
(C) 25%
(D) 30%

13. Identify the correct statement regarding the declaration of the vegetarian/non-vegetarian symbol.
(A) The symbol consists of a filled circle enclosed within a square outline.
(B) The symbol can be placed anywhere on the back panel of the packaging material.
(C) A distinctive green triangle is always used to indicate vegan food products.
(D) Foods containing egg must display a specific yellow circle as a symbol.

14. Identify the incorrect pair regarding mandatory declarations on food labels.
(A) Irradiated food products - Standard Radura symbol
(B) Certified organic food - Official Jaivik Bharat logo
(C) Medical foods (FSMP) - Red cross symbol
(D) Fortified food products - Blue-colored +F logo

15. What is the most appropriate reason for standardizing serving sizes across similar food products in nutritional labelling?
(A) To maximize the perceived nutritional value of the product during marketing campaigns
(B) To dictate the exact physical portion that a consumer must eat during every meal
(C) To reduce the design and printing costs of the nutrition information panel

Downloaded from www.pdf.tube

endpoints.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

33. Which of the following statements regarding digital labelling systems (like QR codes) on food packaging is incorrect?
(A) QR codes can store significantly more data and information than standard one-dimensional barcodes.
(B) FSSAI allows QR codes to replace physical printing of nutritional info.
(C) They can easily provide dynamic links directing consumers to a product's batch-specific testing reports.
(D) They facilitate significantly easier access to allergen information for visually impaired consumers via mobile applications.

34. Match the traceability components in List I with their descriptions in List II:
List I: (Component)
P. Trace backwards
Q. Trace forwards
R. Internal traceability
S. GTIN
List II: (Description)
I. Tracking the movement of ingredients through the manufacturing process
II. Identifying the immediate suppliers of raw materials
III. A globally unique number used to identify trade items
IV. Tracking the distribution path of the finished product to immediate customers
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-II, R-I, S-III
(C) P-II, Q-I, R-IV, S-III
(D) P-II, Q-IV, R-I, S-III

35. How is traceability primarily defined under the Food Safety and Standards Act?
(A) The ability to track any food or feed through all stages of production and distribution
(B) The visual detection and verification of chemical or physical contaminants in food products
(C) The chemical analysis process used to identify the geographical origin of synthetic additives
(D) The systematic method of tracking and analyzing consumer buying behavior in major retail stores

36. Consider the following information elements:
I. Origin of raw materials
II. Processing records and parameters
III. Dispatch and distribution records
IV. Consumer's home storage conditions
Which of the above elements are mandatory components of an industrial food traceability system?
(A) II, III, and IV only
(B) I, III, and IV only
(C) I, II, and III only
(D) I, II, III, and IV

NODIA

37. Given below are two statements:
Statement I: A "one step back, one step forward" traceability approach is a minimum requirement for Food Business Operators under general food safety regulations.
Statement II: This approach requires an FBO to know the origin of the seeds used by farmers three steps down the supply chain.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

38. Arrange the steps of a product recall initiated due to a traceability trigger in the logical sequence.
1. Defective batch identification through distribution records
2. Isolation of the defect cause through internal traceability
3. Notification to the supply chain and regulatory authorities
4. Public advisory and physical retrieval of the product
(A) 2, 1, 3, 4
(B) 1, 2, 3, 4
(C) 2, 3, 1, 4
(D) 1, 3, 2, 4

39. Identify the correct pair related to labelling and traceability technologies.
(A) RFID - Optical machine-readable representation of data using parallel lines
(B) EAN-13 - A 13-digit standard barcode used globally for point-of-sale items
(C) QR Code - 1-dimensional code limited to 20

protocols
(D) To reduce the financial loss associated with unsaleable inventory

57. When organizing a walk-in refrigerator that stores both raw materials and finished products, how should the items be arranged to prevent cross-contamination?
(A) Raw poultry stored on the top shelf, with ready-to-eat salads on the bottom shelf
(B) All items can be mixed in any order as long as they are in sealed containers
(C) Raw meats should be kept near the door, salads at the back
(D) Ready-to-eat salads on the top shelf, raw poultry on the bottom shelf

58. Identify the correct statement regarding food storage temperatures.
(A) The "Danger Zone" where bacteria multiply rapidly is 5°C to 60°C.
(B) All frozen food products should be ideally stored at a constant 0°C.
(C) Standard commercial refrigerators must be maintained at 10°C to prevent chilling injury.
(D) Dry groceries must be stored at temperatures below freezing to completely prevent weevils.

59. Identify the incorrect pair regarding warehouse storage equipment and its function.
(A) Hygrometer - Measures relative humidity
(B) Barometer - Measures the microbial load in the air
(C) Data logger - Continuously records temperature over time
(D) Air curtain - Prevents the entry of warm air and flying insects through open doorways

60. What is the most appropriate action if a storage facility experiences a power failure causing the freezer temperature to rise to 15°C for 24 hours?
(A) Refreeze the food immediately once municipal power returns and prepare it for sale.
(B) Discard highly perishable items if thawed and above 5°C for hours.
(C) Cook all the thawed food immediately and store it uncovered at room temperature.
(D) Move the food to a warm dry storage area to dry out any surface condensation.

61. What is the optimal storage temperature range for tropical fruits like bananas to prevent chilling injury while delaying ripening?
(A) 0°C to 2°C
(B) 4°C to 6°C
(C) 13°C to 15°C
(D) 20°C to 25°C

62. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): Toxic chemical rodent baits should never be placed inside food processing or raw material storage areas.
Reason (R): There is a high risk of the rodents carrying the toxic bait into the food, or the bait itself cross-contaminating the food products.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

63. Which of the following statements about pest control in food storage facilities is incorrect?
(A) Integrated Pest Management (IPM) focuses on prevention rather than relying solely on chemical eradication.
(B) Gaps under exterior doors should be sealed with weather stripping or bristle sweeps to prevent rodent entry.
(C) Empty wooden pallets should be regularly inspected at the warehouse as they can harbor dangerous pests.
(D) UV light traps for flying insects should be placed directly above food prep zones.

64. Match the common food storage pests in List I with their typical signs of infestation in List II:
List I: (Pest)
P. Rodents (Rats/Mice)
Q. Cockroaches
R. Weevils
S. Indian meal moths
List II: (Sign of Infestation)
I. Small boreholes in grains and presence of fine dust
II. Webbing on the surface of stored flour or nuts
III. Greasy rub marks along baseboards and droppings
IV. Egg casings (oothecae) and pepper-like

Click Here to Buy book on Amazon

prevent mold growth on dry goods.
(B) Adequate ventilation is necessary to prevent the accumulation of odors and toxic gases.
(C) Pallets should be placed right against the warehouse walls to maximize storage space.
(D) Temperature mapping of a warehouse helps identify hot and cold spots.

49. Match the optimal relative humidity (RH) conditions in List I with the corresponding food categories in List II:
List I: (RH Condition)
P. Very high RH (90-95%)
Q. Moderate RH (50-60%)
R. Low RH (below 40%)
S. Variable RH depending on packaging
List II: (Food Category)
I. Dehydrated powders (e.g., milk powder)
II. Fresh leafy vegetables
III. Canned goods in cartons
IV. Dry grains and pulses
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-IV, R-I, S-III
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-I, R-IV, S-III

50. How is "cross-contamination" specifically defined in the context of food storage?
(A) The physical mixing of two entirely different brands of the same general food item
(B) The standard process of rotating stock from the back of the storage shelf to the front
(C) The temporary fluctuation of storage temperature during a localized power outage
(D) The transfer of hazards from raw foods to ready-to-eat foods

51. Consider the following warehouse design features:
I. Smooth, non-absorbent floors
II. Adequate lighting with shatterproof covers
III. Open drainage systems running through storage aisles
IV. Minimum 18 inches clearance between stored goods and walls
Which of the above are recommended principles for hygienic warehouse design?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

52. Given below are two statements:
Statement I: High storage temperatures generally accelerate the chemical deterioration and microbial growth in food products.
Statement II: For every 10°C rise in temperature within physiological limits, the rate of biochemical reactions typically doubles (Q10 effect).
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

53. A warehouse operator receives two batches of canned beans. Batch X was manufactured in January and expires in December. Batch Y was manufactured in February and expires in November. To properly implement FEFO, which batch should be placed at the front of the picking rack?
(A) Batch Y, because it expires first
(B) Batch X, because it was manufactured first
(C) Batch X, because it was received first
(D) It does not matter for canned goods

54. Identify the correct pair of a storage practice and its primary benefit.
(A) Stacking heavy cartons directly on the warehouse floor - Enhances structural cooling efficiency
(B) Storing raw meat directly above ready-to-eat foods - Prevents liquid drip contamination
(C) Using porous wooden pallets in highly wet areas - Significantly improves sanitation
(D) Leaving space near walls - Prevents moisture transfer and aids inspection

55. What is the most likely effect of poor ventilation and high humidity in a dry food storage warehouse?
(A) Premature biochemical ripening of canned and preserved foods
(B) Condensation on surfaces causing mold and can corrosion
(C) Rapid and unexpected freezing of internal water supply pipes
(D) Decreased water activity inside hermetically sealed food packages

56. All of the following are valid reasons for maintaining proper stock rotation (FIFO/FEFO) in a food storage facility, EXCEPT:
(A) To minimize food waste due to expiry
(B) To ensure consumers receive products with optimal quality
(C) To deliberately bypass batch traceability

Downloaded from www.pdf.tube

over long distances.
(B) Transport vehicles are completely exempt from pest control measures since they are almost always moving.
(C) Empty food transport containers must be cleaned and sanitized before reuse.
(D) It is acceptable for warehouse personnel to walk on top of bulk food commodities if they wear clean shoes.

89. Identify the incorrect pair regarding temperature monitoring in transit.
(A) Data Logger - Provides a historical record of temperature during transit
(B) Time-Temperature Indicator (TTI) label - Visually indicates if a product has been exposed to temperature abuse
(C) Thermocouple - Used for rapid spot checks of food core temperature
(D) Bimetallic Stemmed Thermometer - Continuously transmits GPS location of the truck

90. What is the most appropriate reason for implementing a strict vehicle sanitation protocol before loading food?
(A) To prevent cross-contamination from previous cargo, biofilms, and pests
(B) To indirectly improve the overall fuel efficiency and speed of the delivery truck
(C) To strictly comply with highway traffic and cargo weight optimization regulations
(D) To ensure that the delivery truck driver has a clean and pleasant working environment

91. Which of the following is a mandatory GMP requirement for bulk liquid food tankers (e.g., milk or juice)?
(A) They must be painted bright white on the entire inside storage surface.
(B) They must be marked "For Food Use Only" and dedicated to food.
(C) They must be kept completely empty of oxygen during the transit period.
(D) They must have internal wooden baffles to prevent rapid liquid surging.

92. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): Transporting food products and hazardous non-food chemicals (like pesticides) in the same vehicle compartment is strictly prohibited.
Reason (R): Chemical spills or volatile fumes can easily cross-contaminate the food products, causing severe toxicological hazards.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

93. Which of the following statements regarding the prevention of cross-contamination during transport is incorrect?
(A) Fertilizer pallets are safe for packaged foods in cardboard boxes.
(B) Raw agricultural commodities should always be physically segregated from ready-to-eat processed foods.
(C) Strong-smelling foods like fish must be transported in tightly sealed containers to prevent odor transfer.
(D) Securing the cargo with proper physical lashing prevents physical damage and microbial contamination.

94. Match the type of contamination during transport in List I with its specific example in List II:
List I: (Type of Contamination)
P. Physical Contamination
Q. Chemical Contamination
R. Biological Contamination
S. Allergenic Contamination
List II: (Example)
I. Residues of cleaning sanitizers left in a milk tanker
II. Wood splinters from broken pallets piercing food packaging
III. Spillage of peanut flour onto a pallet of wheat flour
IV. Growth of Salmonella on raw chicken due to temperature abuse
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-III, R-II, S-I
(C) P-II, Q-I, R-IV, S-III
(D) P-II, Q-IV, R-I, S-III

95. In the context of food handling and logistics, what does "cross-contact" specifically refer to, as opposed to cross-contamination?
(A) The physical transfer of pathogenic bacteria from raw meat to fully cooked meat

NODIA

droppings in dark crevices
(A) P-IV, Q-III, R-II, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-IV, R-I, S-II
(D) P-III, Q-I, R-IV, S-II

65. What does the term "Fumigation" refer to in the context of food warehouse pest control?
(A) The use of high-pressure water jets to clean warehouse floors
(B) Applying a lethal gas to eradicate pests in an enclosed space
(C) The cryogenic process of rapidly freezing stored grains to kill insect eggs
(D) The strategic use of synthetic pheromone traps to capture flying insects

66. Consider the following storage conditions for different food categories:
I. Onions and potatoes should be stored together in a cool, dark, and highly humid environment.
II. Fresh fish should be stored buried in crushed ice close to 0°C.
III. UHT milk in aseptic packaging must be stored in a refrigerator prior to opening.
IV. Edible oils should be stored away from direct sunlight to prevent oxidative rancidity.
Which of the above statements are correct?
(A) I and II only
(B) I, III, and IV only
(C) II, III, and IV only
(D) II and IV only

67. Given below are two statements:
Statement I: Controlled Atmosphere (CA) storage for apples typically involves lowering the oxygen level and increasing the carbon dioxide level.
Statement II: This atmospheric modification accelerates the respiration rate of the apples, making them ripen faster.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

68. Arrange the steps of an Integrated Pest Management (IPM) program in a food facility in the correct logical sequence:
1. Implementation of physical and chemical control measures
2. Identification and monitoring of pest activity
3. Evaluation and documentation of treatment effectiveness
4. Elimination of pest access points, food, and water sources (Sanitation/Exclusion)
(A) 4, 2, 1, 3
(B) 2, 4, 1, 3
(C) 1, 2, 4, 3
(D) 4, 1, 2, 3

69. Identify the correct pair of a pest and its appropriate non-chemical control method in a food storage area.
(A) Flying insects (Flies) - Air curtains at entrance doors
(B) Rodents - Sticky pheromone boards
(C) Stored product insects (Weevils) - Ultrasonic repellers
(D) Birds - Fogging with pyrethrins

70. What is the physiological cause of chilling injury when tropical fruits (like mangoes or bananas) are stored at temperatures below their critical threshold (e.g., 2°C)?
(A) Intracellular ice crystal formation directly rupturing the delicate plant cell walls
(B) Extremely rapid multiplication of cold-tolerant psychrotrophic bacterial species
(C) Complete and permanent cessation of plant ethylene hormone production forever
(D) Metabolic imbalance causing membrane damage, pitting, and discoloration

71. All of the following are considered preventive non-chemical methods of pest control in a food warehouse, EXCEPT:
(A) Installing 16-mesh screens on all openable windows
(B) Routine application of residual organophosphate sprays along the internal baseboards
(C) Maintaining a vegetation-free perimeter of at least 18 inches around the building exterior
(D) Immediate cleanup of grain and sugar spills

72. A warehouse manager decides to store highly odorous foods like raw onions in the same cold room as butter and milk to save space. What is the most likely concept applied and its outcome?
(A) Concept of cross-utilization; achieving highly efficient physical space management.
(B) Concept of synergistic preservation; onion volatile compounds will preserve the butter.
(C) Flavor transfer: milk and butter absorb

Click Here to Buy book on Amazon

(A) Organic and conventionally grown produce must never be transported in the same truck under any circumstances.
(B) If mixed loads are unavoidable, ready-to-eat foods must be securely packaged and placed above raw foods.
(C) Segregation is only required for international shipping, not domestic transport.
(D) Heavy crates should always be stacked on top of lighter, fragile boxes to hold them down.

104. Identify the incorrect pair regarding transportation documentation and its purpose.
(A) Cleaning Certificate - Official proof that a bulk tanker has been completely sanitized
(B) Bill of Lading - Details the specific type, total quantity, and destination of the goods
(C) MSDS - Replaces the nutritional label for bulk food commodities
(D) Temperature Log - Continuous log that proves the entire cold chain was maintained

105. What is the best method to prevent physical contamination (like dust and exhaust fumes) of fresh produce transported in open trucks?
(A) Spraying the fresh agricultural produce with a heavy, protective coat of synthetic wax
(B) Driving the transport vehicle at very high speeds to blow any surface dust off the crop
(C) Transporting the agricultural produce exclusively during cool night hours to avoid dust
(D) Covering the load with clean, food-safe tarpaulins

106. Which of the following microbiological pathogens is most commonly associated with waterborne contamination in Indian street foods like Panipuri?
(A) Salmonella and E. coli
(B) Clostridium botulinum spores
(C) Listeria monocytogenes strains
(D) Aspergillus flavus molds

107. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): Indian street foods are immensely popular among all socio-economic classes.
Reason (R): Street foods are typically inexpensive, easily accessible, offer traditional flavors, and provide ready-to-eat convenience.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

108. Which of the following is generally considered an incorrect statement regarding the characteristics of typical street food vending in developing countries?
(A) Food vending operations are often completely informal and heavily reliant on manual human labor.
(B) They operate from permanent, regulated, brick-and-mortar restaurants.
(C) They frequently lack basic access to clean running water and proper sewage waste disposal systems.
(D) The ready-to-eat food is usually prepared on the street or at home and then sold on the street.

109. Match the popular regional Indian street foods in List I with their predominant state/city of origin in List II:
List I: (Street Food)
P. Vada Pav
Q. Chole Bhature
R. Puchka
S. Litti Chokha
List II: (State/City of Origin)
I. Bihar
II. West Bengal
III. Maharashtra
IV. Delhi/Punjab
(A) P-III, Q-IV, R-II, S-I
(B) P-IV, Q-III, R-I, S-II
(C) P-III, Q-II, R-IV, S-I
(D) P-I, Q-II, R-III, S-IV

110. How do organizations like the FAO and WHO define "Street Foods"?
(A) Any edible food item that is accidentally dropped on the public street and then salvaged for reuse
(B) Highly processed, pre-packaged industrial snacks sold exclusively in modern air-conditioned supermarkets
(C) Ready-to-eat food and drinks prepared/sold by hawkers in streets or public places
(D) Any kind of raw or processed food item that is physically transported over local municipal

(B) The traditional physical process of cooling perishable food using only natural block ice
(C) A series of uninterrupted temperature-controlled storage and distribution
(D) The complex chemical process of breaking down raw fats under extremely cold temperatures

81. Consider the following hygiene requirements for food transport vehicles:
I. The cargo compartment must be made of easy-to-clean, non-toxic materials.
II. Vehicles used for transporting toxic chemicals can be used for food if washed with water once.
III. There must be a separation between the driver's cabin and the cargo area.
IV. Open trucks are strictly prohibited for transporting unpackaged fresh raw milk.
Which of the above statements are correct under Good Manufacturing Practices (GMP)?
(A) I, II, and III only
(B) I, III, and IV only
(C) II, III, and IV only
(D) I, II, III, and IV

82. Given below are two statements:
Statement I: Transport vehicles carrying chilled foods must be pre-cooled to the desired transport temperature before loading the food.
Statement II: Loading chilled food into a warm truck body will force the refrigeration unit to overwork, leading to localized temperature abuse of the outer cargo.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

83. During a 10-hour transit, a reefer truck carrying pasteurized milk experiences a refrigeration failure. The data logger shows the temperature remained at 18°C for the last 6 hours of the journey. What is the most appropriate regulatory action upon arrival?
(A) Reject the shipment due to temperature abuse and microbial hazard.
(B) Accept the milk, cool it down very quickly, and process it immediately for retail.
(C) Accept the shipment but add artificial chemical preservatives to kill any bacteria.
(D) Freeze the milk solid and distribute it immediately to sell it as gourmet ice cream.

84. Identify the correct pair of a specialized transport vehicle and the food it is specifically designed to carry.
(A) Open hopper truck - Fresh, highly delicate strawberries
(B) Standard open flatbed truck - Frozen blocks of raw fish
(C) Insulated Tanker with CIP - Bulk milk or edible oils
(D) Industrial cryogenic freezing tunnel - Dry wheat flour powder

85. What is a primary cause of condensation (sweating) on the surface of chilled food products during transport and offloading?
(A) Exposure of chilled product to warm, humid air at the loading dock
(B) The vehicle's main refrigeration cooling unit running excessively cold
(C) Excessive and uncontrolled use of solid dry ice inside the cargo hold
(D) The physical process of vacuum sealing and packaging of the food items

86. All of the following actions constitute a "break" in the cold chain, EXCEPT:
(A) Leaving a heavy pallet of frozen meat on a hot, sunny loading dock for two hours
(B) Transporting highly perishable chilled dairy in an uninsulated, non-refrigerated van
(C) Storing frozen ice cream in a retail freezer displaying a constant temperature of -5°C
(D) Transferring products to a cold room through a sealed dock shelter

87. A transporter needs to ship frozen peas and chilled yogurt in the same delivery round. They utilize a multi-compartment vehicle. Which concept is being successfully applied here?
(A) Specialized atmospheric modification of the vehicle cargo area
(B) Temperature zoning to prevent thawing or chilling injury
(C) High-temperature short-time transport process for perennials
(D) Thermal pasteurization of liquids while in road transit

88. Identify the correct statement regarding Good Manufacturing Practices (GMP) in food transportation.
(A) Cardboard boxes provide sufficient insulation to ship frozen foods in regular dry trucks

Downloaded from www.pdf.tube

onion odors due to high fat content.
(D) Concept of temperature mapping; onions require the exact same chill conditions as butter.

73. Identify the correct statement regarding "Ultra Low Oxygen" (ULO) storage.
(A) It is primarily used for storing frozen meats to completely prevent long-term freezer burn.
(B) It involves vacuum sealing individual plastic retail packets of processed dry snacks.
(C) It is a specialized chemical fumigation technique utilized to treat bulk stored grains.
(D) It keeps oxygen at 1-2% to restrict respiration in fruits like apples.

74. Identify the incorrect pair regarding the food category and its standard optimal storage temperature.
(A) Fluid Pasteurized Milk - 15°C to 20°C
(B) Frozen Ice Cream - Below -18°C
(C) Fresh Poultry Meat - 0°C to 4°C
(D) Dry Spices - Ambient room temperature (20°C to 25°C)

75. What is the most critical and fundamental aspect of pest control in any food storage facility?
(A) Hiring an expensive professional exterminator to spray chemicals once a year
(B) Maintaining sanitation and structural exclusion to deny pests food and shelter
(C) Applying hazardous broad-spectrum chemical pesticides on a weekly schedule
(D) Keeping the internal warehouse areas entirely dark and unlit at all times

76. What is the globally accepted standard maximum temperature for the long-term storage and transportation of frozen foods to halt microbial growth?
(A) 0°C
(B) -4°C
(C) -10°C
(D) -18°C

77. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): The cold chain must be maintained continuously from the point of harvest or slaughter to the consumer's refrigerator.
Reason (R): Any significant break in the cold chain can allow temperature-abused foods to support the rapid growth of pathogenic microorganisms.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

NODIA

78. Which of the following statements regarding refrigerated transport vehicles (reefer trucks) is incorrect?
(A) The primary function of a reefer truck is to maintain the pre-cooled temperature of the product during transit.
(B) They must be equipped with continuous temperature monitoring and recording devices.
(C) Reefer trucks are designed to rapidly cool down warm food products loaded into them.
(D) Air circulation around the stacked pallets is critical for maintaining uniform temperature inside the truck.

79. Match the cold chain components in List I with their functions in List II:
List I: (Component)
P. Blast Freezer
Q. Reefer Container
R. Cold Room
S. Phase Change Materials (PCMs)
List II: (Function)
I. Used to maintain temperature of perishables during long-distance maritime or road transport
II. Substances used in passive cooling boxes that absorb or release latent heat to maintain specific temperatures
III. Equipment used to rapidly freeze food products to prevent large ice crystal formation
IV. An insulated warehouse space used for short or medium-term chilled storage
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-III, R-II, S-I
(C) P-III, Q-IV, R-I, S-II
(D) P-III, Q-I, R-IV, S-II

80. In food logistics, how is the "Cold Chain" best defined?
(A) A physical chain made of heavy stainless steel used to tow broken refrigerated vehicles

(B) The accidental physical crushing of cargo boxes during heavy road transport
(C) The warehouse mixing of expired products and fresh stock on the same shelf
(D) Inadvertent transfer of an allergen to a food not containing it

96. Consider the following practices in food transportation:
I. Inspecting the vehicle for foul odors before loading.
II. Using dirty tarpaulins to cover fresh produce to protect them from rain.
III. Documenting a cleaning certificate for bulk tankers before loading.
IV. Transporting live poultry and processed poultry meat in the same unpartitioned truck.
Which of the above practices adhere to GMP guidelines?
(A) I and II only
(B) II, III, and IV only
(C) I and III only
(D) I, III, and IV only

97. Given below are two statements:
Statement I: Plastic pallets are generally preferred over wooden pallets in hygienic food transport and storage because they are non-porous and easier to clean.
Statement II: Wooden pallets easily absorb moisture, harbor bacteria, and can introduce physical hazards like nails and splinters.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

98. Arrange the following steps in the correct GMP sequence for preparing a bulk liquid tanker for transporting a new batch of pasteurized milk:
1. ATP swabbing or visual inspection to verify cleanliness
2. Clean-In-Place (CIP) using alkaline and acidic detergents
3. Draining the previous cargo completely
4. Final rinse with potable water and application of food-grade sanitizer
(A) 3, 2, 4, 1
(B) 2, 3, 1, 4
(C) 3, 4, 2, 1
(D) 1, 2, 3, 4

99. Identify the correct pair of a transport hazard and the appropriate preventive measure.
(A) Condensation in containers - Use of desiccants and ventilation
(B) Leaving truck cargo doors wide open during transit to blow them away
(C) Deliberately storing raw coffee beans next to fresh garlic
(D) Heavily lubricating the metal floor of the truck body

100. What is the most direct consequence of improper lashing and securing of cargo pallets inside a transport vehicle?
(A) The vehicle's refrigeration unit will consume significantly more fuel during transit.
(B) The fresh food items and raw agricultural produce will undergo faster ripening.
(C) Package damage causing breached hermetic seals and food spoilage.
(D) The delivery driver will immediately and permanently lose their commercial license.

101. All of the following are recognized GMP standards for loading food into transport vehicles, EXCEPT:
(A) Leaving the truck engine running to emit exhaust into the loading bay
(B) Checking the core temperature of chilled foods with calibrated probes prior to loading
(C) Verifying that the vehicle interior is entirely free of structural defects like holes
(D) Securing the cargo doors with serialized, tamper-evident plastic seals after loading

102. A bulk tanker previously hauled non-food grade industrial alcohol. A transporter wants to wash it and use it to transport drinking water. According to strict food safety principles, is this application appropriate?
(A) Yes, if thoroughly washed with high-pressure hot water and commercial chlorine sanitizers.
(B) Yes, because industrial alcohol evaporates completely and leaves absolutely no chemical residue.
(C) No, because municipal water will rapidly rust the interior metal lining of the storage tank.
(D) No, because non-food tankers cannot be used for food due to contamination risk.

103. Identify the correct statement regarding the segregation of foods during transport.

Click Here to Buy book on Amazon

alphanumeric characters
(D) Blockchain - A chemical marker added to food to trace its origin

40. What is a primary cause for modern food supply chains adopting blockchain technology for traceability?
(A) It drastically reduces the physical weight and complexity of the packaging materials.
(B) It completely eliminates the need for conducting regular laboratory testing of finished products.
(C) It provides an immutable ledger that prevents tampering with records.
(D) It entirely replaces the necessity of printing standard barcodes at physical retail checkouts.

41. All of the following data points can be typically encoded and retrieved via an advanced 2D matrix barcode (like a QR code) on food packaging, EXCEPT:
(A) Promotional videos, marketing campaigns, and brand storytelling elements
(B) Comprehensive allergen profiles and ingredient warning statements
(C) Digital certificates of analysis and safety reports for the specific batch
(D) The exact time the individual consumer will eat the food

42. A company imports olive oil from Spain, blends it with local sunflower oil in India, and bottles it. How should the country of origin be declared on the label?
(A) The label must declare Spain as the origin and that it was blended in India
(B) It should simply and exclusively declare "Product of India" on the primary panel
(C) It should simply and exclusively declare "Product of Spain" on the primary panel
(D) No country of origin declaration is required once the oils have been blended together

43. Identify the correct statement regarding barcode usage on food products in India.
(A) Barcodes are strictly decorative elements designed to enhance packaging aesthetic.
(B) Barcodes help automate inventory management and product traceability.
(C) A barcode must always be printed using bright red ink to ensure optical scanner readability.
(D) FSSAI strictly mandates that all unbranded loose foods sold by street vendors must carry barcodes.

44. Identify the incorrect pair regarding traceability documentation.
(A) Bill of Lading - Forward traceability
(B) Consumer's receipt - Backward traceability to the farmer
(C) Raw material Goods Receipt Note (GRN) - Standard backward traceability
(D) Master Manufacturing Record - Full internal product traceability

45. What is the most appropriate reason for implementing a robust traceability system beyond regulatory compliance?
(A) To minimize the financial impact of product recalls
(B) To artificially increase the overall retail price of the finished food product
(C) To completely avoid declaring allergens on the physical packaging materials
(D) To eliminate the ongoing need for pest control operations in storage facilities

46. In the context of warehouse stock rotation, what does the acronym FEFO stand for?
(A) First Expired, First Out
(B) First Engineered, First Operated
(C) First Expiring, First Out
(D) First Evaluated, First Output

47. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): In the food industry, FEFO is generally prioritized over FIFO for perishable goods.
Reason (R): FEFO ensures that products with the shortest remaining shelf life are dispatched first, regardless of when they were received into the warehouse.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

48. Which of the following statements about principles of food storage is incorrect?
(A) Relative humidity must be controlled to

NODIA

road networks

111. Consider the following safety hazards in street food vending:
I. Use of non-potable water for washing utensils and preparing food
II. Prolonged holding of cooked food at ambient temperatures
III. Use of newspapers for serving hot fried foods
IV. Providing hand sanitizers to consumers
Which of the above represent significant food safety concerns?
(A) I and II only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, and III only

112. Given below are two statements:
Statement I: The use of unboiled, unfiltered municipal tap water is perfectly safe for preparing cold street food beverages like juices and sherbets.
Statement II: Pathogenic microorganisms such as Vibrio cholerae and Hepatitis A virus can easily be transmitted through contaminated water and ice used in street foods.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

113. An outbreak of foodborne illness is traced back to a street vendor selling egg rolls. Investigations reveal the vendor cracks raw eggs with his hands, uses a soiled cloth to wipe his hands, and then uses the same hands to roll the cooked paratha and add raw onions. What is the primary cause of this outbreak?
(A) Insufficient internal cooking and heating of the dough paratha
(B) Cross-contamination from poor hygiene and bad handwashing.
(C) Heavy chemical contamination from the commercial liquefied cooking gas
(D) Intentional chemical or physical adulteration of the raw onions

114. Identify the correct pair of a street food hazard and its most likely source.
(A) Acrylamide toxicity - Accidental addition of unpermitted synthetic food colors
(B) Mycotoxin/Aflatoxin - Storing boiled white rice at warm ambient temperatures
(C) Physical glass shards - Serving meals to consumers using cheap plastic spoons
(D) Heavy metal contamination - Dust and exhaust fumes on uncovered food

115. What is the primary chemical hazard effect caused by a street food vendor repeatedly reusing the same cooking oil for deep frying over several days?
(A) Formation of toxic polar compounds and carcinogenic PAHs
(B) Significant and rapid increase in the overall natural levels of Vitamin E
(C) Rapid multiplication of pathogenic Salmonella bacteria in the boiling oil
(D) The chemical structure of the oil converts into a safe, trans-fat free lipid

NODIA

116. All of the following are typical characteristics that make street foods highly popular among urban populations, EXCEPT:
(A) Provision of traditional, localized flavors
(B) Speed of service (fast food)
(C) High cost compared to formal dining
(D) Accessibility near workplaces and transit hubs

117. A street vendor prepares large batches of chicken curry at 8:00 AM and keeps it in a large pot at ambient temperature (30°C) until 4:00 PM to serve customers. Which critical food safety principle is being severely violated here?
(A) Time-Temperature Control
(B) Proper labeling requirements
(C) Allergen segregation
(D) Traceability

118. Identify the correct statement regarding the vulnerability of different types of street foods.
(A) Dry, deep-fried snacks (like namakpara) pose a higher microbiological risk than cut fruits.
(B) Freshly squeezed fruit juices with added ice cubes are completely sterile under all conditions.
(C) Boiling food vigorously for 10 minutes ensures it remains sterile for 48 hours at room temperature.
(D) Moisture-rich, neutral pH foods held at room temp have the highest bacterial risk.

119. Identify the incorrect pair regarding the transmission of pathogens through street food.
(A) Norovirus - Infected vendor handling ready-

to-eat food bare-handed
(B) Trichinella spiralis - Contaminated municipal drinking water
(C) Bacillus cereus - Fried rice held at warm ambient temperatures
(D) Staphylococcus aureus - Coughing or sneezing over uncovered food

120. In the context of street food carts, what acts as the primary vector for both cross-contamination of utensils and the proliferation of waterborne pathogens?
(A) The physical metal surface of the cooking pan used during frying operations
(B) The highly compressed propane gas cylinder used for all primary cooking needs
(C) A single bucket of static water used repeatedly to rinse plates.
(D) The raw paper plates and disposable wood utensils used for serving customers

121. Under the FSSAI initiatives, which specific certification is awarded to a cluster of street food vendors who meet strict hygiene and infrastructure standards?
(A) Eat Right Station
(B) Blissful Hygienic Offering to God (BHOG)
(C) Hygiene Star Rating
(D) Clean Street Food Hub

122. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): The "Clean Street Food Hub" initiative by FSSAI aims not only to ensure food safety but also to promote local tourism and preserve culinary heritage.
Reason (R): By upgrading the infrastructure and hygiene practices of popular street food clusters, consumer trust is enhanced, attracting more domestic and international tourists.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

123. Which of the following is an incorrect statement regarding the criteria for a cluster to be recognized as a Clean Street Food Hub?
(A) The cluster must consist of a minimum of 50 consecutive street food vendors (or fewer depending on the city tier).
(B) The vendors must completely abandon traditional recipes and only sell packaged industrial foods.
(C) Every vendor in the hub must hold a valid FSSAI registration or license.
(D) The hub requires basic infrastructure like access to potable water, common waste disposal, and pest control.

124. Match the FSSAI initiatives in List I with their primary target sectors in List II:
List I: (FSSAI Initiative)
P. Clean Street Food Hub
Q. RUCO (Repurpose Used Cooking Oil)
R. BHOG
S. Eat Right Campus
List II: (Target Sector)
I. Places of worship
II. Workplaces and educational institutions
III. Street food vendor clusters
IV. Frying operations (vendors and restaurants)
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II
(C) P-I, Q-II, R-III, S-IV
(D) P-III, Q-I, R-IV, S-II

125. What is the fundamental definition of a "Clean Street Food Hub" as per FSSAI?
(A) A street food cluster preparing and selling food under FSSAI hygiene standards
(B) A dedicated state-of-the-art mobile application that catalogs traditional street food recipes
(C) A certified analytical laboratory where local street foods are systematically analyzed for safety
(D) A strict municipal program focused on banning mobile street vendors from busy city business centers

126. Consider the following hygiene practices for street food vending:
I. Wearing clean aprons, hairnets, and gloves when handling food.
II. Keeping raw and cooked foods in separate, covered containers.
III. Using printed newspaper to absorb excess oil from fried foods.
IV. Emptying garbage bins only once a week to save disposal bags.
Which of the above practices are recommended hygienic practices?

Downloaded from www.pdf.tube

(A) I, II, and III only
(B) II and IV only
(C) I and II only
(D) I, III, and IV only

127. Given below are two statements:
Statement I: Personal hygiene of the street food vendor is one of the most critical factors in preventing foodborne illnesses.
Statement II: Vendors suffering from infectious diseases, open wounds, or jaundice are permitted to handle food as long as they wear gloves.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

128. Arrange the general steps required for a cluster to achieve the "Clean Street Food Hub" certification in the correct sequence:
1. Pre-audit gap analysis of the vendor cluster
2. Training of vendors (FoSTaC) and infrastructural improvements
3. Final third-party audit to ensure FSSAI standards are met
4. Identification of the cluster by the State FDA

(A) 4, 1, 2, 3
(B) 1, 2, 3, 4
(C) 4, 2, 1, 3
(D) 2, 4, 1, 3

129. Identify the correct pair of an infrastructure requirement at a street food stall and its primary hygiene purpose.
(A) Wooden chopping boards for fresh meat - Effectively prevents expensive steel knives from blunting
(B) Stainless steel countertops - Easy to clean and rust-resistant
(C) Open plastic dustbins - Conveniently allows easy tossing of food waste from a far distance
(D) High-wattage tungsten bulbs directly over food - Instantly kills harmful bacteria through heat

130. What is the direct chemical hazard associated with serving hot, oily street foods on printed newspaper?
(A) Rapid and massive increase in the overall trans-fat content of the served hot food
(B) Accidental introduction of active Salmonella bacteria directly from the paper surface
(C) Severe chemical bleaching and degradation of the natural or added food coloring agents
(D) Transfer of lead and toxic printing inks into the food

131. All of the following are mandatory infrastructure or practice requirements for maintaining a safe street food vending cart, EXCEPT:
(A) A permanent air-conditioning unit installed on the cart
(B) Provision of a closed, foot-operated waste bin
(C) Access to a continuous supply of clean, potable water
(D) Smooth, easily cleanable surfaces for food preparation

132. A street food vendor washes their hands by merely dipping them in a small bowl of cold water without soap before rolling dough. What is the most significant flaw in this practice?
(A) Using cold water causes the raw flour dough to become excessively stiff and unworkable.
(B) Residual water on the hands will significantly dilute the distinctive flavor of the dough.
(C) No soap or friction fails to remove grease, soil, and microbes.
(D) The food safety regulations mandate using industrial hand sanitizer instead of tap water.

133. Identify the correct statement regarding waste disposal at street food operations.
(A) Solid waste must be segregated, covered, and cleared daily.
(B) Liquid waste like leftover gravies can be legally poured directly into open street storm drains.
(C) All accumulated paper and plastic waste should be burned next to the stall to prevent pest buildup.
(D) Empty plastic wrappers should be mixed with food waste to feed stray animals roaming in the streets.

134. Identify the incorrect pair regarding design flaws in a street vending cart and the resulting hazard.
(A) Rusted iron structure - Physical contamination (rust flakes)
(B) Uncovered food display - Biological and physical contamination (flies, dust)
(C) Deep, hard-to-reach corners in storage boxes - Accumulation of dirt and pest harborage

NODIA

milligrams, and cholesterol is expressed on the panel using milligrams instead of micrograms.

10. (A) To help consumers identify and restrict empty calories linked to diseases
Mandating the separation of added sugars from total carbohydrates on food packaging allows consumers to easily identify and limit the intake of empty calories. High consumption of added sugars is directly associated with chronic non-communicable lifestyle conditions, and this distinct labeling requirement empowers individuals to make healthier choices to reduce obesity and diabetes risks.

11. (B) Fortified edible vegetable oils
While raw agricultural commodities, packaged drinking water, and single herbs are exempt from nutritional tables because of their negligible or uniform composition, fortified products are not exempt. Fortified edible vegetable oils must clearly declare their nutrient profiles, specifically detailing vitamins A and D, to verify compliance with fortification standards and inform consumers of the enhanced nutritional content.

12. (A) 15%
A product containing fifteen grams of protein per hundred grams yields seven point five grams of protein per fifty-gram serving. Dividing this serving amount by the recommended daily allowance of fifty grams and multiplying by one hundred results in exactly fifteen percent, which represents the daily value of protein provided by a single consumption serving.

13. (A) The symbol consists of a filled circle enclosed within a square outline.
The standard symbol used to denote the vegetarian or non-vegetarian status of food consists of a filled circle inside a square outline of specified dimensions. For vegetarian foods, this symbol is green, while non-vegetarian foods use brown, and it must be displayed on the principal display panel in a location that is easily visible to consumers.

14. (C) Medical foods (FSMP) - Red cross symbol
Medical foods or Foods for Special Medical Purposes are not permitted to use the red cross symbol, as this emblem is reserved exclusively for medical services and humanitarian organizations. Instead, specific regulatory text and design requirements are mandated for these products to clearly differentiate them from regular foods and prevent any misleading health or cure representations.

15. (D) To help consumers compare nutritional content between different brands
Standardizing serving sizes across similar food categories enables consumers to easily compare nutritional information, such as sugar, fat, and sodium content, between different brands. This consistency eliminates confusion caused by varying manufacturer portion estimates, facilitating healthier dietary choices and making food labels a practical tool for monitoring overall nutrient intake in daily diets.

16. (C) Use By Date
The expiration or use-by date indicates the end of the estimated period under any stated storage conditions after which the food product may pose safety risks. Beyond this specific date, the food might contain harmful pathogenic microorganisms and should not be consumed, unlike best-before dates which primarily indicate a decline in sensory quality.

17. (A) Both A and R are true and R is the correct explanation of A.
Allergens must be declared on food labels even when present only through accidental cross-contact in a shared facility. This strict requirement exists because trace amounts can trigger severe, life-threatening immunological or anaphylactic reactions in highly sensitive individuals. Proper precautionary labeling is therefore essential to prevent severe health consequences and ensure food safety.

18. (D) Claims that a food cures a human disease are allowed if it has medicinal herbs.
Food safety regulations strictly prohibit any claims that a food product can prevent, treat, or cure a human disease, regardless of whether it contains medicinal herbs or natural extracts. Such therapeutic or curative claims are reserved exclusively for pharmaceutical drugs and require robust medical registration and clinical validation under different regulatory authorities.

19. (A) P-IV, Q-III, R-II, S-I
In food allergen labeling, gluten is scientifically associated with grain crops like rye, crustaceans refer to aquatic species such as prawns, tree nuts include specific botanical seeds like macadamia

Click Here to Buy book on Amazon

142. Given below are two statements:
Statement I: Fortification of raw materials (like using double fortified salt or fortified edible oil) is encouraged among street food vendors to improve the nutritional profile of street food.
Statement II: Fortification alters the taste, texture, and visual appeal of the street food, making it unpopular.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I is true but Statement II is false.
(D) Statement I is false but Statement II is true.

143. A person wishes to start a small mobile cart selling boiled sweet corn on the street, expecting a daily sale of Rs. 1000. Which regulatory document must they obtain before starting operations?
(A) A State FSSAI License
(B) A Central FSSAI License
(C) No documentation is required for boiled items
(D) An FSSAI Registration Certificate

144. Identify the correct pair regarding FSSAI Schedule 4 Part IV requirements for street food vendors.
(A) Vending location - Can be safely situated adjacent to an open municipal garbage dump
(B) Cutting boards - Must be made of highly porous wood to fully absorb meat juices
(C) Water for cooking - Must be of potable quality (IS 10500)
(D) Vendor attire - Loose open sandals and sleeveless undershirts are strictly mandatory

145. What is the cause-and-effect relationship between mandatory FoSTaC training and public health?
(A) Training drastically increases vendor compliance costs, causing a massive reduction in street food consumption, thereby improving overall municipal health.
(B) Training improves hygiene knowledge, reducing contamination and illnesses.
(C) Training teaches raw food vendors exactly how to add heavy chemical preservatives to their food, making all street food last practically forever.
(D) Training completely eliminates any further need for official FSSAI registration and monitoring, significantly reducing the administrative regulatory burden.

NODIA

146. All of the following are explicit requirements under Schedule 4 (Part IV) of the Food Safety and Standards Regulations for petty street food vendors, EXCEPT:
(A) Vending carts must be kept clean and free from pests.
(B) Food must be covered to protect it from dust and flies.
(C) Vendors must maintain clean personal hygiene and trim their nails.
(D) Vendors must have a master's degree in food technology.

147. A public health initiative wants to improve the micronutrient intake of daily wage workers who rely heavily on a specific street food hub. Which of the following is the most practical concept application?
(A) Training vendors to use +F fortified salt and oil in existing recipes
(B) Legally banning the commercial sale of any deep-fried or oily food items at the entire hub
(C) Forcing unorganized street vendors to exclusively cook and serve raw or boiled green broccoli
(D) Systematically handing out synthetic vitamin pills to consumers with every plate of food sold

148. Identify the correct statement regarding the display of the FSSAI registration certificate.
(A) It must be kept locked in a drawer at the vendor's home.
(B) It only needs to be shown if a food safety officer explicitly asks for it.
(C) It must be prominently displayed at the vending cart/stall at all times.
(D) It must be printed on every paper plate used to serve food.

149. Identify the incorrect pair regarding regulatory forms for Food Business Operators under FSSAI.
(A) Form D - Medical fitness certificate for street vendors
(B) Form A - Standard official application form for FSSAI Registration
(C) Form B - Standard official application form for FSSAI Licensing
(D) Form C - Certificate of Registration issued to a petty FBO

150. What is the ultimate, most appropriate goal of providing Food Safety Training and Certification (FoSTaC) to millions of unorganized street food vendors in India?

(A) To aggressively collect massive training fees to exponentially increase state government revenue

(B) To eventually replace all active human street vendors with fully automated mechanical vending machines

(C) To extensively teach unorganized local vendors how to cook and serve high-end international cuisines

(D) To formalize the sector, ensuring safe food while protecting livelihoods.

www.nodia.in

Downloaded from www.pdf.tube

ANSWERS

1. (B) The text “Contains Genetically Modified Ingredients” on the front label
FSSAI regulations mandate that any packaged food containing genetically modified ingredients exceeding the threshold of one percent must prominently display the specified text declaration on the front of the pack. This ensures transparency and helps consumers make informed choices regarding biotechnology in their diet without relying on symbols that may be easily misunderstood.

2. (A) Both A and R are true and R is the correct explanation of A.
Indian food safety regulations mandate the display of a vegetarian or non-vegetarian logo on the principal display panel of all packaged food products. This visual representation serves to inform consumers immediately of the nature of the product, thereby supporting their dietary preferences, cultural values, and religious choices through clear and accessible labelling on the retail package.

3. (A) Vitamins and minerals must be declared as a percentage of daily value, omitting metric weights.
Food safety standards require vitamins and minerals to be declared on the nutritional information panel using actual metric units such as milligrams or micrograms in addition to the percentage of daily value. Omitting these metric values violates standard labelling guidelines designed to provide complete, precise, and transparent nutrient values to consumers for health tracking.

4. (C) P-IV, Q-III, R-I, S-II
Standard packaging definitions dictate that the principal display panel is the primary visual area shown to consumers, the batch number serves as a unique identification mark for tracing, the date of manufacture indicates when the product became the described food, and the best before period signifies the duration during which the food maintains its peak quality.

5. (A) An amount of food customarily consumed per eating occasion, expressed in metric units
Food safety regulations define serving size as the quantity of a food product that is customarily consumed by an individual during a single eating occasion. This quantity must be clearly expressed on the label using standardized metric measurements, allowing consumers to easily understand nutritional intake and compare different brands of similar products accurately.

6. (D) I, II, and III only
FSSAI guidelines dictate that all packaged food products must carry essential information, including the official regulator logo along with the license number, the precise net quantity of the contents, and the manufacturer name and address. Promotional elements like celebrity signatures are entirely optional marketing features that are not legally required for safety compliance.

7. (A) Both Statement I and Statement II are true.
Mandatory disclosure of trans fat content on nutritional panels ensures that consumers are fully aware of heart-damaging lipids in food products. Additionally, regulatory bodies define the specific threshold for making a trans-fat-free claim at less than zero point two grams per hundred grams or milliliters, establishing strict, standardized criteria for health-related packaging claims.

8. (A) 2, 4, 3, 1
Ingredients must be listed on food labels in descending order of their incoming weight during manufacturing. Consequently, major ingredients are listed first, followed by added water used in processing, then spices and condiments, and finally food additives which are generally present in the smallest proportions within the finalized formulation to perform technical functions.

9. (D) Energy - kilocalories (kcal)
Standard nutrition labelling in India requires specific parameters to be reported in standardized units to prevent consumer confusion. Energy value must be declared using kilocalories or kilojoules, whereas other nutrients like total carbohydrates are declared in grams, sodium is measured in

NODIA

(D) Lack of a shade or canopy - Rapid chilling of hot foods in summer

135. What is considered the most effective and sustainable intervention to improve the hygiene of street food operations on a large scale?
(A) Banning all street food vendors entirely from operating within major urban municipal boundaries
(B) Providing accessible hygiene training and behavioral change programs.
(C) Forcing vendors to build permanent brick-and-mortar concrete shops at their own personal expense
(D) Issuing heavy, non-negotiable financial penalties and court warnings without any prior notice

136. What does the acronym FoSTaC stand for in the context of FSSAI's food safety training initiatives?
(A) Food Standard Testing and Compliance
(B) Food Street Trading and Commerce
(C) Food Safety Training and Certification
(D) Food Sanitation Technique and Control

137. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): Many traditionally fried Indian street foods have a high nutritional density in terms of calories but are often poor in micronutrients.
Reason (R): Street foods like samosas, bhature, and jalebis are typically high in refined carbohydrates, saturated fats, and sodium.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

138. Which of the following statements regarding the regulatory requirements for street food vendors under FSSAI is incorrect?
(A) FSSAI Registration is completely optional for street food vendors.
(B) Petty food manufacturers and street vendors with an annual turnover of up to Rs. 12 Lakhs only need an FSSAI Registration, not a full License.
(C) Registered vendors must display their photo-bearing FSSAI registration certificate at their cart.
(D) They must adhere to the basic sanitary and hygienic requirements laid out in Schedule 4, Part IV of the FSS Regulations.

139. Match the FoSTaC training levels/courses in List I with their target audience in List II:
List I: (FoSTaC Course)
P. Basic Catering
Q. Advance Catering
R. Special - Street Food Vending
S. Advance Manufacturing
List II: (Target Audience)
I. Large scale food processing industries
II. Small eateries, dhabas, and petty food business operators
III. Large restaurants, hotels, and institutional caterers
IV. Hawkers and mobile food carts
(A) P-I, Q-II, R-III, S-IV
(B) P-II, Q-III, R-IV, S-I
(C) P-IV, Q-III, R-II, S-I
(D) P-II, Q-IV, R-I, S-III

140. How does FSSAI define a "Petty Food Business Operator (FBO)" which encompasses most street food vendors?
(A) Any mobile food business operating entirely outdoors regardless of its net annual income
(B) An FBO with an annual turnover up to Rs. 12 lakhs.
(C) Any food business that generates an annual turnover exceeding Rs. 50 lakhs
(D) Only localized vendors selling completely raw, uncut fruits and seasonal vegetables

141. Consider the following regulatory requirements for petty street food vendors under FSSAI:
I. Must possess a valid FSSAI Registration Certificate (Form C).
II. Must employ a full-time certified Food Safety Supervisor.
III. Must follow basic hygiene requirements as per Schedule 4.
IV. Must submit quarterly chemical analysis reports of their food from NABL labs.
Which of the above are actual requirements for petty vendors?
(A) I and III only
(B) I, II, and III only
(C) II and IV only
(D) I, III, and IV only

Click Here to Buy book on Amazon

nuts, and soybeans are the raw agricultural source of legumes used to produce products like tofu, all requiring clear declaration on packaging.

20. (C) The period the food remains marketable and retains its specific qualities
The best before date indicates the period during which the food product remains fully marketable and retains all of its sensory, physical, and nutritional qualities under proper storage. It is primarily a quality-related indicator rather than a safety deadline, meaning the product might still be legally and safely consumed past this date.

21. (A) I, II, and IV only
Under standard food safety rules, products with short shelf lives under seven days require complete day, month, and year declarations, while longer-lasting goods need month and year details. Alcoholic beverages exceeding ten percent alcohol are exempt from expiry requirements, whereas spices do not carry mandatory use-by dates as they do not support microbial growth.

22. (C) Statement I is true but Statement II is false.
Regulations define a low-fat claim for solid foods based on a threshold of less than three grams of fat per hundred grams. However, a sugar-free claim does not require zero carbohydrates; instead, it specifies that the product must contain less than zero point five grams of sugars per hundred grams or milliliters, allowing non-sugar carbohydrates.

23. (B) It violates allergen labelling rules, making the product misbranded.
Omitting the presence of a known major allergen like peanuts on a food label violates mandatory allergen labeling regulations, which classifies the product as misbranded. This failure to warn consumers poses serious health risks to sensitive individuals and exposes the manufacturing business to legal penalties, regulatory actions, and immediate product recalls.

24. (C) Nutrient Content Claim - “Rich in Vitamin C”
A nutrient content claim describes the level of a specific nutrient present in a food product, exemplified by the phrase rich in vitamin C. In contrast, stating low in sodium is a nutrient content claim, whereas disease risk reduction claims must link a nutrient or substance directly to a reduced risk of a specific medical condition.

25. (D) Undeclared presence of a major milk allergen
Failing to declare whey powder on a food label leads to the undeclared presence of a major milk allergen in a product marketed as dairy-free. Since milk proteins can cause severe allergic reactions in sensitive consumers, this regulatory non-compliance presents an immediate safety hazard, necessitating a rapid recall of the affected food batches.

26. (A) Refined soy oil
Highly refined edible oils, such as fully refined soy oil, are generally exempt from mandatory allergen labeling because the intensive refining process removes almost all allergenic proteins. In contrast, foods containing intact wheat gluten, cheese proteins, or tree nuts retain high levels of active allergens and must clearly declare these ingredients on the packaging.

27. (B) No, because “Low Sugar” requires less than 2.5g per 100ml in liquids.
A low-sugar claim on liquid food products is invalid if the sugar content is four point five grams per hundred milliliters. Regulatory guidelines dictate that for a liquid to be labeled as low sugar, it must contain no more than two point five grams of sugar per hundred milliliters of the beverage, protecting consumers from misleading health claims.

28. (B) It must be declared on all imported food products.
FSSAI regulations make country of origin labeling mandatory for all imported food products sold in India. This requirement ensures full transparency for consumers regarding the geographical origin of their food and cannot be omitted or bypassed by simply repacking the imported bulk commodity into smaller retail containers within the domestic market.

29. (A) MSG (Monosodium Glutamate) - Major food allergen requiring bold highlighting
Monosodium glutamate is a flavor enhancer and is not classified as one of the major food allergens requiring bold highlighting on packaging. While some individuals may experience sensitivity to this compound, true IgE-mediated food allergies are triggered by proteins like casein in milk, albumin in eggs, or wheat gluten, which require mandatory warning labels.

Downloaded from www.pdf.tube

30. (C) The product cannot be sold as it is non-compliant for sale.
Under food safety regulations, retailers are prohibited from selling any food product that has passed its best before date. Even if the food does not present an immediate biological safety hazard, selling expired stock is a non-compliance issue that can lead to regulatory penalties and represents a failure to maintain quality standards for consumers.

31. (D) GS1 Barcodes (GTIN)
The standard digital system used globally and in India to facilitate rapid identification and traceability of food products at retail points is the GS1 barcode system utilizing Global Trade Item Numbers. This standardized format enables automated stock tracking, ensures seamless logistics, and links physical food products to digital records across the entire supply chain.

32. (A) Both A and R are true and R is the correct explanation of A.
A robust traceability system enables food businesses to perform precise, selective product recalls instead of withdrawing an entire product line. This efficiency is possible because the system connects the batch number of the finished food directly to raw material lots, processing dates, and specific distribution endpoints, minimizing financial losses and protecting public health.

33. (B) FSSAI allows QR codes to replace physical printing of nutritional info.
Digital labelling systems like QR codes provide useful supplemental data and improve accessibility for visually impaired consumers, but they are not permitted to replace the physical printing of mandatory nutritional information on food packaging. Core regulatory elements, including ingredients, shelf life, and allergen warnings, must remain directly visible to consumers without electronic aids.

34. (D) P-II, Q-IV, R-I, S-III
Traceability protocols define tracing backward as identifying immediate suppliers of raw materials, and tracing forward as tracking the distribution path of finished goods to customers. Internal traceability tracks ingredients within the processing facility, while the global trade item number acts as a unique identifier for trade items within logistics networks.

NODIA

35. (A) The ability to track any food or feed through all stages of production and distribution
The Food Safety and Standards Act defines traceability as the ability to track and follow any food, feed, food-producing animal, or substance intended to be incorporated into food through all stages of production, processing, and distribution. This system is crucial for identifying contamination sources and executing swift, targeted product recalls.

36. (C) I, II, and III only
Industrial food traceability systems must document the origin of raw materials, internal processing records, and final distribution paths to direct buyers. These elements are under the control of the manufacturer, unlike consumer storage conditions in private homes, which cannot be monitored or recorded as part of the industrial supply chain records.

37. (C) Statement I is true but Statement II is false.
The one step back, one step forward principle represents the baseline requirement for food business traceability, ensuring operators can identify immediate suppliers and immediate customers. However, this model does not require the food business to track deep history like the seed source of a farm multiple steps down the supply chain.

38. (A) 2, 1, 3, 4
When executing a product recall, a manufacturer must first isolate the root cause through internal traceability, then identify the affected batches using distribution records. Afterward, the business notifies supply chain partners and regulatory authorities before releasing a public advisory to physically retrieve the unsafe food products from the market.

39. (B) EAN-13 - A 13-digit standard barcode used globally for point-of-sale items
The EAN-13 barcode is a thirteen-digit standard symbol recognized globally for identifying products at retail points of sale. It facilitates rapid checkout and automated inventory tracking, whereas other technologies like RFID use radio waves instead of optical scanning, and QR codes are two-dimensional matrices capable of holding significant amounts of data.

40. (C) It provides an immutable ledger that prevents tampering with records.
Blockchain technology is increasingly adopted in food logistics because it provides a decentralized, immutable ledger that prevents the tampering of records. This digital security ensures that critical food safety data, including temperature logs, ingredient origins, and processing dates, remain authentic and fully transparent to all participants across the complex supply chain.

41. (D) The exact time the individual consumer will eat the food
Two-dimensional barcodes can store and deliver extensive data such as marketing links, allergen profiles, and batch testing reports directly to smartphones. However, they cannot predict or record the exact future time a consumer will choose to eat the food, as consumer behavior is highly variable and outside the scope of pre-printed packaging data.

42. (A) The label must declare Spain as the origin and that it was blended in India
When imported ingredients are processed or blended in another country, food labeling laws require complete transparency. The label must explicitly state the original country of origin of the imported oil and clarify that the final blending and packaging took place in India, preventing any misleading representations about the true source of the raw materials.

43. (B) Barcodes help automate inventory management and product traceability.
Barcodes are essential technical tools printed on food packaging to automate inventory management and support product traceability. By scanning these standardized symbols, retailers and manufacturers can instantly track stock movements, reduce errors in supply chain logistics, and quickly access batch details during recall events without relying on manual entry.

44. (B) Consumer's receipt - Backward traceability to the farmer
A consumer receipt documents the point-of-sale transaction at a retail store, but it does not provide direct backward traceability to the original farmer. Connecting a finished retail product back to the farm requires internal manufacturer records, goods receipt notes, and supplier invoices that link the raw agricultural lots to specific production batches.

45. (A) To minimize the financial impact of product recalls
Implementing a robust traceability system allows a food business operator to minimize the financial impact of product recalls by pinpointing and withdrawing only the specific affected batches. This precise tracking prevents the need for a massive, costly recall of unaffected products, protecting the brand reputation and reducing overall waste.

46. (C) First Expiring, First Out
In food warehouse management and logistics, the acronym FEFO stands for First Expiring, First Out. This inventory management methodology prioritizes the dispatch of food products with the shortest remaining shelf life, ensuring that stock is rotated efficiently and reducing the risk of products expiring in storage before reaching retail markets.

47. (A) Both A and R are true and R is the correct explanation of A.
The food industry prioritizes First Expiring, First Out over First In, First Out for perishable goods because chemical and biological quality depends on expiration. This method ensures that products closest to their expiry are distributed first, even if they arrived at the warehouse later than other batches, thereby minimizing waste and preserving safety.

48. (C) Pallets should be placed right against the warehouse walls to maximize storage space.
Placing storage pallets directly against warehouse walls is an incorrect storage practice because it restricts proper air circulation and hinders visual inspection for pest activity or moisture build-up. Safe warehouse design requires maintaining a clear gap between stored goods and exterior walls to support ventilation and facilitate regular cleaning operations.

49. (B) P-II, Q-IV, R-I, S-III
Optimal relative humidity levels vary significantly by food category to prevent degradation. Fresh leafy vegetables require very high humidity to prevent wilting, dry grains need moderate humidity to prevent mold, dehydrated powders require low humidity to avoid clumping, and canned goods in cartons need variable humidity controlled to prevent rust and packaging breakdown.

Click Here to Buy book on Amazon

contamination risks rather than presenting a hazard.

112. (D) Statement I is false but Statement II is true.
Unboiled municipal tap water is not safe for preparing cold beverages, as it can harbor infectious pathogens. Waterborne diseases caused by organisms such as Vibrio cholerae and Hepatitis A virus are easily transmitted through contaminated water and ice, making the use of purified or boiled water critical for street food safety.

113. (B) Cross-contamination from poor hygiene and bad handwashing.
The foodborne outbreak was caused by cross-contamination resulting from poor hand hygiene and inadequate washing practices. When a vendor handles raw eggs and then touches ready-to-eat food or fresh ingredients without properly washing and sanitizing their hands, pathogenic bacteria are transferred directly to the food consumed by customers.

114. (D) Dust and exhaust fumes on uncovered food
Heavy metal contamination in street foods is primarily caused by exposing uncovered food products to road dust and vehicular exhaust fumes in busy urban environments. Exhaust emissions contain lead and other toxic particulate matter that settle on exposed food items, presenting long-term chemical health hazards to consumers.

115. (A) Formation of toxic polar compounds and carcinogenic PAHs
Repeatedly reusing cooking oil for deep frying leads to thermal oxidation, polymerization, and hydrolysis. This degradation results in the formation of toxic total polar compounds and carcinogenic polycyclic aromatic hydrocarbons. Consuming food prepared in degraded oil poses significant cardiotoxic and carcinogenic health risks to the human body over time.

116. (C) High cost compared to formal dining
Street foods are popular because they offer cheap, fast, and convenient meals with traditional local flavors close to workplaces and transit hubs. They are not characterized by high costs; rather, their extreme affordability compared to formal dining restaurants makes them a staple food source for budget-conscious urban populations daily.

117. (A) Time-Temperature Control
Holding cooked chicken curry at thirty degrees Celsius for eight hours violates the principle of time-temperature control. Cooked foods must be kept hot above sixty degrees Celsius or cold below five degrees Celsius to prevent rapid bacterial growth, as holding food in the danger zone allows pathogens to multiply to infectious levels.

118. (D) Moisture-rich, neutral pH foods held at room temp have the highest bacterial risk.
Moisture-rich, neutral pH foods held at ambient temperatures present the highest microbiological risk in street food vending. These physiological conditions provide the ideal environment for rapid bacterial proliferation, unlike dry, acidic, or heavily deep-fried foods which are naturally less supportive of pathogenic growth due to lower water activity.

NODIA

119. (B) Contaminated municipal drinking water
Trichinella spiralis is a parasitic roundworm transmitted exclusively through the consumption of raw or undercooked meat, particularly pork, rather than contaminated municipal drinking water. In contrast, waterborne transmission is associated with pathogens like cholera, typhoid, or viruses like Hepatitis A, which are spread through fecal-oral contamination of municipal water supplies.

120. (C) A single bucket of static water used repeatedly to rinse plates.
Using a single bucket of static water repeatedly to rinse plates and utensils acts as a primary vector for cross-contamination. This unhygienic practice accumulates food debris, grease, and pathogenic microorganisms, transferring contaminants from one plate to another and facilitating the rapid transmission of waterborne pathogens to subsequent customers.

121. (D) Clean Street Food Hub
FSSAI awards the Clean Street Food Hub certification to clusters of street food vendors that meet strict hygiene, sanitation, and infrastructure criteria. This initiative is designed to upgrade the safety standards of popular street food locations, ensuring vendors follow good hygienic practices and providing consumers with safe, high-quality dining options.

STUDYING FROM PDFs?

THINK AGAIN.

If you are studying only from PDFs,
you are wasting valuable time.

Research shows that learning from

PRINTED BOOKS has up to

4× HIGHER RETENTION

than studying from screens.

PRINT BOOK = BETTER MEMORY

PDF = LOWER RETENTION

Those who study from **PRINTED BOOKS**
move **AHEAD.**

Others are left **BEHIND**
in competition.

In competitive exams,
being average is not enough.

STAY ONE STEP AHEAD.

60. (B) Discard highly perishable items if thawed and above 5°C for hours.
If a freezer failure allows highly perishable foods to thaw and remain above five degrees Celsius for several hours, these items must be discarded. Refreezing temperature-abused food is unsafe, as pathogens can multiply rapidly during the warm period, and subsequent freezing will not destroy any heat-stable toxins that may have formed.

61. (C) 13°C to 15°C
Tropical fruits like bananas are highly sensitive to cold temperatures and develop chilling injury if stored below their tolerance threshold. The optimal storage range to delay ripening while avoiding physiological damage is thirteen to fifteen degrees Celsius, as colder refrigeration temperatures disrupt cell membranes, causing peel browning and failure to ripen properly.

62. (A) Both A and R are true and R is the correct explanation of A.
Using toxic chemical rodent baits inside food storage or processing areas is strictly prohibited due to severe cross-contamination risks. Rodents can physically carry the chemical bait into food supplies, or the bait may accidentally mix with ingredients. Therefore, pest control within these areas must rely on non-toxic traps, while chemical baits remain outside.

63. (D) UV light traps for flying insects should be placed directly above food prep zones.
Placing ultraviolet flying insect traps directly above food preparation or storage zones is an incorrect pest control practice. Dead insects or fragments can fall from the trap and contaminate the food. These devices should be installed away from open food, near entrance points, to intercept pests before they reach processing areas.

64. (C) P-III, Q-IV, R-I, S-II
Different storage pests leave distinct signs of infestation: rodents are identified by greasy rub marks and droppings, cockroaches leave egg cases and pepper-like debris in dark crevices, weevils create small boreholes in grains accompanied by fine dust, and Indian meal moths produce silk-like webbing on the surface of stored flours.

65. (B) Applying a lethal gas to eradicate pests in an enclosed space
Fumigation is a specialized chemical pest control method that involves releasing a lethal gas into a completely sealed, enclosed space to eradicate insects, rodents, or other pests. This technique is highly effective for treating bulk stored commodities like grains, as the gas can penetrate deep into the product pile to destroy all life stages.

66. (D) II and IV only
Fresh fish must be stored in crushed ice close to zero degrees to preserve quality, and edible oils require storage away from direct sunlight to prevent light-induced oxidative rancidity. In contrast, onions and potatoes should not be stored together as they release gases that accelerate spoilage, and unopened UHT milk is shelf-stable at room temperature.

67. (C) Statement I is true but Statement II is false.
Controlled atmosphere storage preserves fresh apples by lowering oxygen and increasing carbon dioxide levels. However, this environmental modification is designed to slow down the respiration rate and delay natural ripening of the fruit, rather than accelerating it, thereby extending the post-harvest shelf life and maintaining texture for several months.

68. (B) 2, 4, 1, 3
An effective integrated pest management program begins with identifying and monitoring pest activity. Next, facility operators focus on sanitation and structural exclusion to deny pests entry and food. Only then are targeted chemical or physical controls implemented, followed by ongoing evaluation and detailed documentation of the program effectiveness.

69. (A) Flying insects (Flies) - Air curtains at entrance doors
Installing air curtains at warehouse entrance doors is a highly effective non-chemical control method that prevents flying insects from entering the facility. The high-velocity downward air stream forms a physical barrier that flies cannot cross, reducing the reliance on chemical insecticide sprays inside areas where food products are stored or handled.

70. (D) Metabolic imbalance causing membrane damage, pitting, and discoloration
Exposing tropical fruits to temperatures below their critical low threshold triggers a severe cellular metabolic imbalance. This physiological stress damages cell membranes, leading to loss of structural integrity, surface pitting, internal

Downloaded from www.pdf.tube

actually spreads pathogens across subsequent food preparation tasks.

133. (A) Solid waste must be segregated, covered, and cleared daily.
Hygienic waste disposal requires solid waste to be segregated, kept in covered bins, and cleared daily from the stall. Dumping wastewater into open storm drains or burning plastic near the stall is prohibited, as improper waste management attracts disease-carrying vectors like flies and rodents and creates severe environmental sanitation hazards.

134. (D) Lack of a shade or canopy - Rapid chilling of hot foods in summer
A lack of a shade or canopy does not cause rapid chilling of hot foods in summer. Instead, this design flaw exposes food and preparation surfaces to direct sunlight, bird droppings, rainwater, and atmospheric dust, leading to significant temperature abuse, physical contamination, and biological hazards in the served food items.

135. (B) Providing accessible hygiene training and behavioral change programs.
Providing accessible hygiene training and behavioral change programs is the most sustainable way to improve street food safety. Education empowers vendors to understand food safety principles, leading to permanent hygiene improvements, whereas punitive bans or unaffordable infrastructure requirements threaten livelihoods and fail to address the root causes of contamination.

136. (C) Food Safety Training and Certification
In FSSAI initiatives, the acronym FoSTaC stands for Food Safety Training and Certification. This program provides structured training courses to food handlers across various sectors, including catering, manufacturing, and street vending, to improve food safety knowledge, ensure regulatory compliance, and protect public health throughout the nation.

137. (A) Both A and R are true and R is the correct explanation of A.
Many fried Indian street foods are calorie-dense but micronutrient-poor, as they are typically prepared using refined flour, hydrogenated fats, and high sodium levels. While these common ingredients provide quick energy, they lack essential vitamins, minerals, and dietary fiber, contributing to nutritional imbalances when consumed regularly as staple meals.

138. (A) FSSAI Registration is completely optional for street food vendors.
Under food safety regulations, FSSAI registration is not optional for street food vendors. Every petty food business operator with an annual turnover of up to twelve lakh rupees must legally register with the food authority, obtain a registration certificate, and prominently display it at their vending site to ensure compliance.

139. (B) P-II, Q-III, R-IV, S-I
FoSTaC courses are tailored to specific food sectors: Basic Catering trains small dhabas and petty food businesses, Advance Catering is designed for large hotels and restaurants, Special Street Food Vending caters to mobile cart hawkers, and Advance Manufacturing addresses the food safety needs of large-scale processing industries.

140. (B) An FBO with an annual turnover up to Rs. 12 lakhs.
FSSAI defines a petty food business operator as any food business with an annual turnover not exceeding twelve lakh rupees. This category includes street vendors, hawkers, temporary stall owners, and small-scale cottage industries, which are subject to simplified registration requirements rather than the extensive licensing protocols applied to larger enterprises.

141. (A) I and III only
FSSAI regulations require petty street food vendors to hold a valid registration certificate and follow the basic sanitary requirements in Schedule Four. They are not required to employ full-time certified food safety supervisors or submit quarterly laboratory testing reports, which are compliance burdens reserved for larger, licensed food manufacturers.

142. (C) Statement I is true but Statement II is false.
Using fortified raw materials like double fortified salt or fortified oil is actively encouraged to improve the micronutrient intake of populations relying on street foods. This process does not alter the taste, texture, or appearance of dishes, allowing vendors to enhance nutritional quality without affecting customer acceptance of traditional recipes.

NODIA

initial harvest or production all the way through to final retail sale.

81. (B) I, III, and IV only
GMP standards require food transport cargo compartments to be made of non-toxic, easy-to-clean materials, with physical separation from the driver cabin, and prohibit open trucks for bulk raw milk. Using chemical transport vehicles for food after a single water rinse is strictly prohibited due to severe chemical contamination risks.

82. (A) Both Statement I and Statement II are true.
Pre-cooling transport vehicles before loading chilled food is a critical logistical requirement. Loading cold products into a warm truck compartment causes immediate heat transfer from the vehicle walls to the food, forcing the refrigeration unit to work excessively and creating localized hot spots that lead to temperature abuse of the cargo.

83. (A) Reject the shipment due to temperature abuse and microbial hazard.
When a shipment of pasteurized milk is exposed to eighteen degrees Celsius for six hours during transit, it must be rejected upon arrival. This temperature abuse allows rapid multiplication of spoilage and pathogenic bacteria, rendering the milk highly unsafe for consumption and making subsequent cooling or processing ineffective for safety.

84. (C) Insulated Tanker with CIP - Bulk milk or edible oils
Insulated tankers equipped with clean-in-place systems are specifically engineered to transport bulk liquid food items like milk or edible oils. The insulation prevents temperature fluctuations during transit, while the integrated cleaning systems ensure the inner surfaces can be thoroughly washed and sanitized between loads to prevent microbial contamination.

85. (A) Exposure of chilled product to warm, humid air at the loading dock
Condensation on chilled food products occurs when cold surfaces are exposed to warm, humid ambient air, typically during loading or offloading at docks. This temperature differential causes airborne moisture to condense into liquid droplets on the packaging, which can weaken cardboard containers and promote mold growth if not managed.

86. (D) Transferring products to a cold room through a sealed dock shelter
Transferring chilled or frozen food products to a cold storage room through a sealed dock shelter successfully maintains the temperature-controlled environment and prevents ambient heat entry. This correct practice does not break the cold chain, unlike leaving perishable products on warm loading docks or using non-refrigerated vehicles for transit.

87. (B) Temperature zoning to prevent thawing or chilling injury
Using multi-compartment transport vehicles applies the concept of temperature zoning, which allows food products with different thermal requirements to travel together safely. This system keeps frozen items below freezing to prevent thawing while maintaining chilled items above freezing to avoid chilling injury, optimizing delivery efficiency without compromising overall quality.

88. (C) Empty food transport containers must be cleaned and sanitized before reuse.
Good Manufacturing Practices require all empty food transport containers to be thoroughly cleaned and sanitized before they are loaded with new food products. This essential preventive measure eliminates physical residues, microbiological biofilms, and chemical traces from previous shipments, ensuring that subsequent cargo remains unadulterated and safe during distribution.

89. (D) Bimetallic Stemmed Thermometer - Continuously transmits GPS location of the truck
A bimetallic stemmed thermometer is a mechanical device designed to measure temperatures through physical expansion and is not capable of transmitting GPS location data. Tracking vehicle coordinates requires electronic GPS telemetry systems, while other tools like data loggers and chemical indicators are correctly matched to their monitoring functions.

90. (A) To prevent cross-contamination from previous cargo, biofilms, and pests
Implementing strict vehicle sanitation protocols before loading food prevents cross-contamination from chemical residues, biological pathogens, or pests left by previous cargo. Regular washing and sanitizing eliminate persistent microbial biofilms and insect harborage inside the cargo

Click Here to Buy book on Amazon

area, maintaining a clean, food-safe environment throughout the entire transportation process.

91. (B) They must be marked "For Food Use Only" and dedicated to food.
Bulk liquid tankers used for transporting food products must be clearly and permanently marked with the statement For Food Use Only. These vehicles must be strictly dedicated to food transport, preventing any potential chemical contamination that would occur if the tank were used for industrial chemicals or waste.

92. (A) Both A and R are true and R is the correct explanation of A.
Transporting food alongside hazardous chemicals in the same vehicle compartment is strictly prohibited due to severe cross-contamination risks. Chemical spills, dust, or volatile fumes from substances like pesticides can easily penetrate food packaging, leading to dangerous chemical contamination and representing a critical violation of food safety protocols.

93. (A) Fertilizer pallets are safe for packaged foods in cardboard boxes.
Assuming fertilizer pallets are safe for packaged food in cardboard boxes is an incorrect and dangerous practice. Cardboard is highly porous and does not provide an effective barrier against chemical fumes or physical transfers from chemical fertilizers, presenting a serious chemical contamination risk to the food products inside.

94. (C) P-II, Q-I, R-IV, S-III
Contamination types in transit are defined by specific events: physical contamination occurs when wood splinters damage packaging, chemical contamination is caused by residual sanitizers, biological contamination involves pathogen growth like Salmonella due to temperature abuse, and allergenic contamination occurs when peanut flour accidentally spills onto wheat.

95. (D) Inadvertent transfer of an allergen to a food not containing it
In food safety, cross-contact specifically refers to the accidental transfer of an allergenic protein from an allergen-containing food to a food that is formulated to be allergen-free. Unlike biological cross-contamination, which can often be eliminated by cooking, allergenic proteins are highly stable and cannot be destroyed by heat.

96. (C) I and III only
Adhering to GMP guidelines in food transportation includes inspecting vehicles for foul odors prior to loading and documenting cleaning certificates for bulk tankers. Practices such as using dirty tarpaulins to cover fresh produce or transport of live poultry alongside processed meats in unpartitioned spaces are major sanitary violations.

97. (A) Both Statement I and Statement II are true.
Plastic pallets are widely preferred over wood in food logistics because they are non-porous, waterproof, and easy to sanitize. Wooden pallets present high food safety risks because they readily absorb moisture, harbor bacteria and mold, and introduce physical hazards such as splinters, loose nails, or fragments into storage areas.

98. (A) 3, 2, 4, 1
To prepare a bulk tanker, operators must first drain previous cargo completely, then perform an intensive Clean-In-Place cycle using detergents. Afterward, they conduct a final rinse with potable water and apply sanitizer, concluding with ATP swabbing or visual inspection to verify cleanliness before loading the new milk batch.

99. (A) Condensation in containers - Use of desiccants and ventilation
Condensation inside transport containers can damage packaging and foster mold growth. Utilizing desiccants to absorb ambient moisture and ensuring adequate container ventilation are effective preventive measures that control humidity levels during transit, protecting the structural integrity of cardboard boxes and maintaining the overall safety of the food.

100. (C) Package damage causing breached hermetic seals and food spoilage.
Failing to secure cargo pallets inside a truck allows products to shift, slide, or fall during transport. This physical movement results in packaging damage, which can breach the hermetic seals of processed foods, expose the contents to environmental contaminants, and lead to rapid microbiological spoilage and financial loss.

101. (A) Leaving the truck engine running to emit exhaust into the loading bay
Leaving a truck engine idling in the loading bay is a dangerous non-compliant practice because exhaust fumes can enter the warehouse and contaminate food products with toxic chemicals.

NODIA

Correct GMP loading procedures require turning off the engine, verifying cargo temperatures, checking the vehicle interior, and securing doors with seals.

102. (D) No, because non-food tankers cannot be used for food due to contamination risk.
Using a bulk tanker that previously hauled non-food grade industrial chemicals to transport drinking water is strictly prohibited, regardless of the cleaning methods used. Tankers designated for chemical transport pose an unacceptable risk of chemical migration and contamination, and food safety standards require dedicated food-grade transport vessels.

103. (B) If mixed loads are unavoidable, ready-to-eat foods must be securely packaged and placed above raw foods.
When transporting mixed food loads, ready-to-eat products must be placed above raw foods to prevent raw juices or dirt from dripping down and contaminating them. This vertical segregation, combined with secure packaging, is a critical preventive control that reduces cross-contamination risks when utilizing a shared transport compartment.

104. (C) MSDS - Replaces the nutritional label for bulk food commodities
Material Safety Data Sheets provide essential safety instructions for handling hazardous chemicals and are not used to replace nutritional labels on bulk food products. Standard food labelling requirements remain governed by food safety regulations, which mandate clear nutritional panels, ingredient listings, and allergen declarations on all applicable packaging.

105. (D) Covering the load with clean, food-safe tarpaulins
To prevent physical contamination from road dust, vehicle exhaust, and rain during transit in open trucks, operators must cover the cargo with clean, food-safe tarpaulins. This protective barrier shields fresh crops from external environmental hazards while maintaining the overall safety and hygiene of the food during transport.

106. (A) Salmonella and E. coli
Waterborne pathogens like Salmonella and Escherichia coli are commonly associated with contamination in street foods such as Panipuri. This issue typically arises from the use of non-potable water or raw ice in preparing the flavored water, coupled with poor personal hygiene practices of vendors, leading to outbreaks of gastroenteritis.

107. (A) Both A and R are true and R is the correct explanation of A.
Indian street foods enjoy widespread popularity across all socio-economic classes because they provide highly convenient, ready-to-eat meals at affordable prices. Additionally, these food items offer distinct, traditional flavors and are widely accessible near workplaces, making them a practical and culturally preferred dining choice for many urban residents.

108. (B) They operate from permanent, regulated, brick-and-mortar restaurants.
Street food vendors in developing nations typically operate from mobile carts, temporary stalls, or open-air sites rather than permanent, regulated, brick-and-mortar restaurants. This highly informal structure often limits their access to basic infrastructure like running water, electricity, and waste disposal systems, presenting unique regulatory and hygiene challenges.

109. (A) P-III, Q-IV, R-II, S-I
Regional Indian street foods have distinct geographical origins: Vada Pav is synonymous with the culinary culture of Maharashtra, Chole Bhature is highly popular in Delhi and Punjab, Puchka is the traditional term for West Bengal style of panipuri, and Litti Chokha originates from the state of Bihar.

110. (C) Ready-to-eat food and drinks prepared/sold by hawkers in streets or public places
The Food and Agriculture Organization and World Health Organization define street foods as ready-to-eat foods and beverages prepared or sold by vendors and hawkers, especially in streets and other similar public places. This formal definition highlights their convenience, accessibility, and the informal nature of their preparation and sales.

111. (D) I, II, and III only
Significant food safety hazards in street vending include using non-potable water, holding cooked food at ambient temperatures in the danger zone, and serving hot food on printed newspapers. In contrast, providing hand sanitizers to consumers is a recommended hygienic practice that reduces

NODIA

discoloration, and an increased susceptibility to post-harvest decay, as these warm-climate crops lack adaptation to near-freezing environments.

71. (B) Routine application of residual organophosphate sprays along the internal baseboards
Routine application of residual organophosphate sprays along baseboards is a chemical pest control intervention, rather than a non-chemical preventive method. In contrast, non-chemical techniques focus on physical exclusion and sanitation, such as installing mesh window screens, maintaining a clear perimeter around the building, and immediately cleaning up any ingredient spills.

72. (C) Flavor transfer: milk and butter absorb onion odors due to high fat content.
Storing highly odorous foods like onions in the same cold room as butter and milk leads to flavor transfer, as dairy products absorb volatile odors because of their high fat content. To prevent this sensory quality degradation, distinct storage chambers must be utilized for strong-smelling produce and sensitive fat-rich food products.

73. (D) It keeps oxygen at 1-2% to restrict respiration in fruits like apples.
Ultra Low Oxygen storage is a specialized post-harvest preservation technique that maintains oxygen levels at one to two percent within storage chambers. This atmospheric control drastically restricts the natural respiration rate of harvested fruits, such as apples, thereby delaying senescence and preserving flesh firmness and nutritional quality for extended marketing periods.

74. (A) Fluid Pasteurized Milk - 15°C to 20°C
Fluid pasteurized milk must be stored under refrigeration below five degrees Celsius to prevent the rapid growth of spoilage and pathogenic bacteria. Storing milk at fifteen to twenty degrees Celsius is incorrect because these warm temperatures accelerate microbial multiplication, causing rapid spoilage and presenting a significant food safety hazard.

75. (B) Maintaining sanitation and structural exclusion to deny pests food and shelter
The most critical aspect of pest control in any food facility is maintaining excellent sanitation and structural exclusion. Denying pests access to food, water, and harborage sites is far more sustainable than relying on chemical applications, as it addresses the root causes of infestations and prevents pests from establishing nesting areas.

76. (D) -18°C
The globally accepted standard temperature for storing and transporting frozen foods is minus eighteen degrees Celsius or lower. At this cold temperature, microbial growth is completely halted, and enzymatic and chemical degradation reactions are significantly slowed down, preserving the quality, texture, and nutritional value of the food over long periods.

77. (A) Both A and R are true and R is the correct explanation of A.
Maintaining an uninterrupted cold chain from harvest to consumption is essential for preserving perishable food safety and quality. Any significant temperature deviation or break in this chain can allow dormant pathogens to multiply rapidly on temperature-abused foods, creating serious foodborne illness risks and causing premature spoilage of the products.

78. (C) Reefer trucks are designed to rapidly cool down warm food products loaded into them.
Refrigerated transport vehicles are designed to maintain the pre-chilled temperature of cargo during transit, not to cool down warm products loaded into them. Loading warm food into a reefer truck overloads the cooling system, leading to uneven temperature distribution, condensation, and potential temperature abuse of the entire shipment.

79. (D) P-III, Q-I, R-IV, S-II
Cold chain logistics rely on specialized equipment: blast freezers rapidly freeze food to prevent large ice crystal damage, reefer containers maintain transport temperatures over long distances, cold rooms offer insulated storage within facilities, and phase change materials act as passive cooling elements in shipping boxes by absorbing or releasing latent heat.

80. (C) A series of uninterrupted temperature-controlled storage and distribution
The cold chain is defined as an uninterrupted series of temperature-controlled storage, transport, and distribution activities. This logistics system ensures that perishable food items are consistently held within their specific required temperature ranges from the point of

Downloaded from www.pdf.tube

122. (A) Both A and R are true and R is the correct explanation of A.
The Clean Street Food Hub initiative ensures food safety while actively promoting local tourism and preserving regional culinary heritage. Upgrading the infrastructure and hygiene standards of popular street food areas builds consumer confidence, successfully attracting more domestic and international tourists who can safely experience traditional Indian street flavors.

123. (B) The food vendors must completely abandon traditional recipes and only sell packaged industrial foods.
To achieve Clean Street Food Hub recognition, vendors do not need to abandon traditional recipes or switch to selling packaged industrial foods. The program is designed to preserve local culinary heritage while ensuring that traditional street foods are prepared and served under strictly regulated sanitary and hygienic conditions.

124. (B) P-III, Q-IV, R-I, S-II
FSSAI has launched various targeted initiatives: Clean Street Food Hub focuses on street vendor clusters, RUCO addresses recycling used cooking oil from frying operations, BHOG targets food safety in places of worship, and Eat Right Campus is designed to promote healthy, safe food in workplaces and educational institutions.

125. (A) A street food cluster preparing and selling food under FSSAI hygiene standards
FSSAI defines a Clean Street Food Hub as a designated street food cluster that prepares and sells food in compliance with specified food safety and hygiene standards. The program aims to upgrade the quality of popular street vending zones through training, infrastructure improvements, and regular regulatory audits.

126. (C) I and II only
Recommended hygienic practices include wearing clean aprons, hairnets, and gloves, and keeping raw and cooked foods in separate, covered containers. In contrast, using printed newspapers to absorb oil transfers toxic lead inks to food, and emptying garbage bins only once a week attracts pests and creates sanitation hazards.

127. (C) Statement I is true but Statement II is false.
Personal hygiene of food handlers is a critical factor in preventing foodborne contamination. However, vendors suffering from infectious diseases, open wounds, or jaundice are strictly prohibited from handling food under any circumstances, as wearing gloves does not eliminate the serious transmission risks of pathogens like hepatitis or staphylococci.

128. (A) 4, 1, 2, 3
Achieving certification begins with the State FDA identifying the vendor cluster, followed by a pre-audit gap analysis. Next, vendors undergo formal training and implement necessary structural and hygienic improvements. Finally, a rigorous third-party audit is conducted to verify compliance with FSSAI hygiene standards before awarding the certificate.

129. (B) Stainless steel countertops - Easy to clean and rust-resistant
Using stainless steel countertops at food stalls provides a smooth, non-porous surface that is easy to clean, sanitize, and resistant to corrosion. This material prevents the build-up of organic residues and microbial biofilms, unlike porous materials like wood, thereby significantly reducing the risk of cross-contamination in food preparation.

NODIA

130. (D) Transfer of lead and toxic printing inks into the food
Serving hot, oily street food on printed newspapers allows heavy metals like lead and organic chemical solvents present in the printing ink to dissolve and migrate into the food. Consuming food contaminated with these toxic compounds presents severe long-term chemical health hazards, including neurological damage and organ toxicity.

131. (A) A permanent air-conditioning unit installed on the cart
Mandatory requirements for street food carts include foot-operated waste bins, potable water access, and easy-to-clean preparation surfaces. A permanent air-conditioning unit is not a regulatory requirement, as mobile carts operate outdoors where such units are technically impractical and completely unnecessary for basic hygienic food preparation and sales.

132. (C) No soap or friction fails to remove grease, soil, and microbes.
Dipping hands in a bowl of static water without soap fails to remove grease, dirt, and pathogenic microorganisms. Proper handwashing requires running water, soap, and physical friction to break down lipids and rinse away microbes, making static dipping an ineffective practice that

50. (D) The transfer of hazards from raw foods to ready-to-eat foods
In food safety and storage, cross-contamination is specifically defined as the transfer of biological, chemical, or physical hazards from raw foods to ready-to-eat foods. This transfer can occur through direct physical contact, dripping juices, contaminated storage surfaces, or the shared use of unsanitized handling utensils within a warehouse or kitchen environment.

51. (A) I, II, and IV only
Hygienic warehouse design requires smooth, non-absorbent floors, shatterproof lighting covers to prevent glass contamination, and maintaining clear space between stored goods and walls to facilitate pest inspections. Open drainage systems running through storage aisles must be avoided as they present serious sanitation risks, harbor pathogens, and attract unwanted pests.

52. (A) Both Statement I and Statement II are true.
Elevated storage temperatures speed up chemical deterioration and foster rapid microbial growth in foods. This acceleration aligns with basic biological principles where, within physiological limits, a ten-degree Celsius increase in temperature typically doubles the rate of biochemical reactions, significantly reducing the shelf life of food products stored under sub-optimal conditions.

53. (A) Batch Y, because it expires first
Applying the First Expiring, First Out protocol requires placing the batch that expires in November at the front of the picking rack, even though it was manufactured and received later than the other batch. This action ensures that the inventory with the shortest remaining shelf life is distributed first, minimizing waste.

54. (D) Leaving space near walls - Prevents moisture transfer and aids inspection
Maintaining a clear physical gap between stored pallets and warehouse walls is a critical storage practice that prevents moisture transfer from the building structure to the food packages. Additionally, this clear space provides essential access for pest control operators to conduct visual inspections and place monitoring devices along the facility perimeter.

55. (B) Condensation on surfaces causing mold and can corrosion
Inadequate ventilation combined with elevated relative humidity levels in a warehouse leads to moisture condensation on stored surfaces. This excess moisture creates a highly favorable environment for mold growth on paper packaging and induces structural corrosion on metal food cans, compromising both the packaging integrity and the safety of the contents.

56. (C) To deliberately bypass batch traceability protocols
Proper stock rotation is maintained to minimize food waste, ensure consumers receive high-quality products, and reduce financial losses from expired inventory. It is not used to bypass batch traceability protocols; on the contrary, systematic stock rotation works in tandem with traceability systems to ensure accurate tracking of specific product lots through distribution.

57. (D) Ready-to-eat salads on the top shelf, raw poultry on the bottom shelf
To prevent cross-contamination, walk-in refrigerators must be organized with ready-to-eat foods on the top shelves and raw meats or poultry on the bottom shelves. This vertical arrangement prevents raw juices containing pathogenic bacteria from dripping onto foods that will not undergo further cooking before consumption, maintaining strict food safety.

58. (A) The "Danger Zone" where bacteria multiply rapidly is 5°C to 60°C.
The temperature danger zone for food safety is defined as the range between five and sixty degrees Celsius, where foodborne pathogenic bacteria can multiply rapidly. To prevent this proliferation, perishable foods must be kept outside this temperature range, either by chilling them below five degrees Celsius or keeping them hot above sixty degrees.

59. (B) Barometer - Measures the microbial load in the air
A barometer measures atmospheric pressure and is not used to measure or monitor the microbial load in the air of a food storage facility. Air microbiological monitoring requires active air samplers or settling plates, while other tools like hygrometers and data loggers are correctly used to track relative humidity and temperature.

Click Here to Buy book on Amazon

143. (D) An FSSAI Registration Certificate
A small mobile food cart expecting daily sales of one thousand rupees falls under the petty food business category, as the projected annual turnover remains well below twelve lakh rupees. Therefore, the operator must obtain an FSSAI registration certificate before starting commercial operations to comply with national food safety laws.

144. (C) Water for cooking - Must be of potable quality (IS 10500)
Schedule Four of the food regulations mandates that water used for cooking, preparing food, and washing utensils must be of potable quality, meeting Indian Standard ten thousand five hundred. Using clean, safe water is critical to prevent the introduction of pathogens and protect consumers from waterborne food infections.

145. (B) Training improves hygiene knowledge, reducing contamination and illnesses.
Mandatory FoSTaC training directly improves the food safety and hygiene knowledge of street vendors. This vital education leads to cleaner food handling practices, reducing biological and physical contamination risks in street foods, which in turn decreases the incidence of foodborne illnesses and improves overall urban public health outcomes.

146. (D) Vendors must have a master's degree in food technology.
Schedule Four mandates hygiene requirements for petty vendors, including maintaining clean carts, covering foods to protect from dust, and practicing personal hygiene. It does not require vendors to hold academic qualifications like a master's degree in food technology, as registration is designed to be accessible to all informal operators.

147. (A) Training vendors to use +F fortified salt and oil in existing recipes
To improve micronutrient intake among populations relying on street foods, the most practical intervention is training vendors to use fortified ingredients like salt and oil in existing recipes. This approach enhances nutritional value without requiring customers to change their eating habits or forcing vendors to abandon popular traditional dishes.

148. (C) It must be prominently displayed at the vending cart/stall at all times.
Food safety regulations require the FSSAI registration certificate to be prominently displayed at the vending cart or stall at all times. This visible display builds consumer trust, demonstrates regulatory compliance, and allows food safety officers to easily verify the registration status of the petty food business during inspection rounds.

149. (A) Form D - Medical fitness certificate for street vendors
Form D is not a medical fitness certificate; under FSSAI rules, Form D refers to the annual return form submitted by licensed food business operators to report manufacturing and import details. Medical fitness certificates use different formats to confirm that food handlers are free from infectious diseases before working with food.

150. (D) To formalize the sector, ensuring safe food while protecting livelihoods.
The primary goal of providing FoSTaC training to unorganized street food vendors is to formalize the sector. This initiative ensures that street food is prepared under safe, hygienic conditions while protecting the livelihoods of millions of vendors by enabling them to comply with regulatory standards and improve consumer trust.

NODIA

www.nodia.in

(C) Lycopene
(D) Allicin

17. Consider the following statements regarding the extraction of bioactive compounds from fruit by-products:
1. Supercritical fluid extraction utilizes CO_2 to extract non-polar bioactives without leaving toxic solvent residues.
2. Ultrasound-assisted extraction reduces mass transfer and strictly requires high temperatures to function.
3. Polyphenols are typically extracted using polar solvents like aqueous ethanol or methanol.
4. Carotenoids are highly soluble in water and easily extracted using cold aqueous buffers.

Which of the above statement(s) is/are correct?
(A) 1 and 3
(B) 2 and 4
(C) 1, 2, and 3
(D) 3 and 4

18. Which of the following correctly describes the application of polyphenols recovered from fruit processing wastes?
(A) They are primarily used as artificial sweetening agents in zero-calorie beverages.
(B) They serve as the main bulking agents in gluten-free bakery formulations.
(C) They are employed as chemical preservatives to lower the pH of canned foods.
(D) They are used as natural antioxidants to inhibit lipid oxidation in foods.

19. Carotenoids, recovered from vegetable by-products like carrot pomace, are defined primarily as:
(A) Lipid-soluble pigments responsible for yellow, orange, and red colors.
(B) Water-soluble, nitrogen-containing pigments responsible for blue and purple colors.
(C) Proteinaceous surfactant compounds that act as highly efficient natural emulsifiers.
(D) Indigestible and complex structural polysaccharides functioning as dietary fiber.

20. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Apple pomace is extensively processed to produce commercial dietary fiber supplements.
Reason (R): Apple pomace is composed mostly of simple sugars and has a negligible amount of cellulose and hemicellulose.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

21. A researcher is tasked with extracting lycopene from tomato pomace for functional food applications. Which of the following solvent systems is most appropriate for achieving high extraction efficiency?
(A) Hexane or ethyl acetate solvents
(B) Deionized and double-distilled pure water
(C) Highly concentrated aqueous sodium chloride solution
(D) Aqueous solutions of dilute acetic acid

22. Identify the incorrect pair regarding seeds (by-products) and their notable extracted components:
(A) Grape seeds – Proanthocyanidins
(B) Papaya seeds – Benzyl isothiocyanate
(C) Mango kernels – High-quality starch and fat (cocoa butter equivalent)
(D) Citrus seeds – High concentration of amylose and amylopectin

23. Match the bioactive compounds in List I with their fruit/vegetable by-product sources in List II:
List I: (Bioactive Compound)
P. Hesperidin
Q. Resveratrol
R. Bromelain
S. Oleuropein
List II: (Fruit/Vegetable By-Product Source)
I. Pineapple stem/core
II. Citrus peels
III. Olive mill waste
IV. Grape pomace
(A) P-II, Q-IV, R-I, S-III
(B) P-IV, Q-II, R-III, S-I
(C) P-I, Q-III, R-II, S-IV
(D) P-II, Q-I, R-IV, S-III

24. Which of the following is NOT generally recognized as an advanced extraction technique for recovering polyphenols from fruit pomace?
(A) Microwave-Assisted Extraction (MAE)
(B) Pulsed Electric Field (PEF) Extraction

Downloaded from www.pdf.tube

S. Whey Protein Concentrate (WPC)

List II: (Primary Application/Characteristic)

I. Infant formula ingredient to reduce ash content

II. Protein supplement with $> 90\%$ protein content

III. Fermentation substrate for bioethanol

IV. Food additive with 35-80% protein content

(A) P-II, Q-I, R-III, S-IV

(B) P-IV, Q-III, R-I, S-II

(C) P-II, Q-IV, R-III, S-I

(D) P-I, Q-II, R-IV, S-III

9. Which of the following is NOT typically classified as a major whey protein?

(A) β-Lactoglobulin

(B) α-Lactalbumin

(C) Bovine Serum Albumin (BSA)

(D) κ-Casein

10. Identify the correct pair regarding the extraction condition and its purpose in pectin production from apple pomace:

(A) Low pH (Acidic) – Hydrolyzes protopectin into soluble pectin

(B) High pH (Alkaline) – Maximizes the molecular weight of pectin

(C) Room temperature – Enhances the rapid release of methoxyl groups

(D) Addition of calcium – Prevents the precipitation of pectin

11. Read the following statements and identify the correct option:

Statement I: Citrus peels and apple pomace are the two most common commercial sources for pectin extraction globally.

Statement II: Pectin is commercially extracted using a hot dilute alkaline solution followed by precipitation with alcohol.

(A) Both Statement I and Statement II are correct.

(B) Both Statement I and Statement II are incorrect.

(C) Statement I is correct but Statement II is incorrect.

(D) Statement I is incorrect but Statement II is correct.

12. A commercial fruit processing facility intends to extract high methoxyl pectin from citrus peels. During trial runs, the extracted pectin fails to form a gel in the presence of high sugar and acid. What is the most likely operational flaw?

(A) The extraction temperature was too low, leading to incomplete protopectin breakdown.

(B) Excessive acid hydrolysis during extraction caused severe de-esterification.

(C) The precipitation stage utilized ethanol instead of high-purity isopropanol.

(D) The citrus peels were dried prior to extraction, which strictly inhibits pectin recovery.

13. Arrange the standard steps for the commercial extraction of pectin from citrus peel in the correct sequence:

1. Precipitation with alcohol or metal salts
2. Drying and milling of the precipitate
3. Washing and blanching of peels
4. Filtration and concentration of the extract
5. Hot dilute acid extraction

(A) 3, 5, 4, 1, 2

(B) 5, 3, 1, 4, 2

(C) 3, 4, 5, 1, 2

(D) 5, 4, 3, 2, 1

14. Which of the following statements regarding the utilization of fruit peels is incorrect?

(A) Mango peels are an excellent source of dietary fiber and highly extractable polyphenols.

(B) Pomegranate peels possess strong antioxidant properties due to high punicalagin content.

(C) Banana peels contain too much lignin to be digested at all by ruminant livestock.

(D) Citrus peels can be processed to yield both essential oils and high-purity hydrocolloids.

15. What is the primary effect of blanching citrus peels before pectin extraction?

(A) It initiates the rapid fermentation of soluble residual sugars.

(B) It significantly increases the overall ash content of the final pectin.

(C) It converts insoluble low methoxyl pectin into soluble high methoxyl pectin.

(D) It deactivates pectin esterase to prevent pectin degradation.

16. Which specific bioactive compound is abundantly recovered from tomato processing by-products (skin and seeds)?

(A) Anthocyanin

(B) Curcumin

NODIA

tissue.
(B) Type A forms gels upon rapid heating, whereas Type B forms gels upon controlled cooling.
(C) Type A uses acid pretreatment of collagen, while Type B uses alkaline pretreatment.
(D) Type A has a stable isoelectric point of 4.5, whereas Type B has an isoelectric point of 9.0.

49. In meat by-product utilization, what does the term "offal" primarily refer to?
(A) The high-value prime cuts of skeletal muscle meat
(B) The edible internal organs and entrails of an animal
(C) The rendered fat and tallow obtained from carcasses
(D) The organic wastewater discharged after carcass washing

50. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Blood plasma obtained from slaughterhouses is used as a binder and emulsifier in some processed meat products.
Reason (R): Plasma proteins have excellent heat-induced gelation and functional binding properties.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

51. An R&D technologist is formulating a high-protein, clear sports beverage. Why would they choose collagen peptides over intact gelatin for this specific application?
(A) Collagen peptides are fully soluble in cold liquids and do not increase viscosity.
(B) Collagen peptides provide a significantly higher Bloom strength, stabilizing the formulation.
(C) Collagen peptides readily precipitate at low acidic pH, making the beverage very cloudy.
(D) Intact gelatin molecules undergo rapid Maillard browning compared to collagen peptides.

52. Identify the incorrect pair regarding meat processing by-products and their industrial utilization:
(A) Bovine hide – High-quality leather and gelatin production
(B) Bone chips – Standard bone meal and calcium supplements
(C) Poultry feathers – Extraction of functional whey proteins
(D) Animal intestines – Production of natural sausage casings

53. Match the meat/fish by-products in List I with their key applications or products in List II:
List I: (Meat/Fish By-Product)
P. Fish swim bladder
Q. Porcine skin
R. Bovine bone
S. Poultry feathers
List II: (Key Application or Product)
I. Hydrolyzed keratin for feed
II. Isinglass (used for clarifying beverages)
III. Type A Gelatin
IV. Type B Gelatin and bone ash
(A) P-II, Q-III, R-IV, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-I, R-II, S-IV
(D) P-II, Q-IV, R-III, S-I

54. Which of the following is NOT an application of gelatin in the food industry?
(A) Gelling agent in gummy candies
(B) Clarifying agent in fruit juices and wine
(C) Stabilizer in ice cream and dairy products
(D) Primary leavening agent in baked goods

55. Identify the correct pair regarding fish processing by-products:
(A) Fish maw – A rich source of high-quality industrial fish oil and lipids
(B) Fish silage – Liquefied waste produced by endogenous enzymes and acid
(C) Fish meal – A liquid protein extract used exclusively as a food colorant
(D) Fish scale – The primary source of bioactive Omega-3 fatty acids

56. Read the following statements and identify the correct option:
Statement I: Fish meal is a dry powder obtained by cooking, pressing, drying, and grinding whole fish or fish trimmings.
Statement II: Fish meal is primarily used as a

Click Here to Buy book on Amazon

(C) High-Temperature Destructive Distillation
(D) Pressurized Liquid Extraction (PLE)

25. Identify the correct pair concerning the utilization of cereal bran:
(A) Wheat bran – Primarily utilized for oil extraction due to its $> 40\%$ lipid content
(B) Oat bran – Extracted solely for the production of phytic acid
(C) Corn bran – Used exclusively to produce high fructose corn syrup
(D) Rice bran – Rich source of γ-oryzanol and tocopherols

26. Read the following statements and identify the correct option:
Statement I: Cereal brans are concentrated sources of dietary fiber, minerals, and B-vitamins compared to the endosperm.
Statement II: The incorporation of wheat bran into bread dough typically increases the loaf volume and improves gluten network formation.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

27. A bakery is incorporating 15% defatted rice bran into a cookie formulation to increase fiber content, but sensory panels report a gritty texture and reduced dough cohesion. Which process modification would most effectively mitigate this issue?
(A) Substituting the rice bran with an equivalent amount of whole wheat flour
(B) Extrusion cooking or micronization of the rice bran prior to incorporation
(C) Significantly increasing the baking temperature by 50°C
(D) Thoroughly washing the rice bran with hexane solvent before baking

28. When evaluating the antioxidant capacity of polyphenol-rich extracts obtained from grape pomace, which assay is primarily based on single electron transfer and is most frequently utilized in food science?
(A) Standard Kjeldahl nitrogen determination method
(B) DPPH radical scavenging spectrophotometric assay
(C) Soxhlet continuous ether extraction analysis
(D) Lane-Eynon volumetric copper reduction method

29. Which of the following statements about rice bran stabilization is incorrect?
(A) Stabilization permanently fortifies the bran with synthetic antioxidants.
(B) Rice bran must be stabilized immediately after milling to prevent rapid enzymatic hydrolysis of lipids.
(C) Lipase enzymes in the raw bran cause a rapid accumulation of free fatty acids (FFA).
(D) Stabilization is usually achieved through dry or moist heat treatments, such as extrusion.

30. What is the primary cause-and-effect relationship regarding the high susceptibility of raw rice bran to rancidity?
(A) Cause: High moisture retention; Effect: Rapid growth of molds that secrete hazardous aflatoxins.
(B) Cause: Direct exposure to intense light; Effect: Photo-oxidation of complex starch molecules.
(C) Cause: Milling cellular disruption; Effect: Lipase-oil interaction yielding free fatty acids.
(D) Cause: Total absence of natural antioxidants; Effect: Complete protein denaturation within hours.

31. Which unique bioactive compound present in rice bran oil is known for its cholesterol-lowering properties?
(A) Sesamin
(B) Gossypol
(C) Glucoraphanin
(D) γ-Oryzanol

32. Consider the following statements about rice bran oil (RBO) extraction and refining:
1. RBO is traditionally extracted using hexane as a solvent.
2. High levels of free fatty acids (FFA) in crude RBO result in high refining losses during chemical neutralization.
3. Physical refining is strictly prohibited for RBO due to the volatility of oryzanol.
4. Dewaxing is a critical step in RBO refining to ensure oil clarity at lower temperatures.

Downloaded from www.pdf.tube

incinerates organic food waste to generate steam power.
(B) A traditional petroleum processing plant that occasionally refines crude vegetable oils.
(C) A municipal wastewater treatment plant dedicated solely to reducing biological oxygen demand.
(D) An integrated facility converting biomass into biofuels, biochemicals, and food ingredients.

64. Bioethanol, produced from food processing waste, is best defined as:
(A) Methyl alcohol produced by the destructive chemical distillation of wood by-products.
(B) A long-chain fatty acid alcohol extracted and purified from crude marine fish oil.
(C) Ethanol produced by anaerobic yeast fermentation of carbohydrate-rich wastes.
(D) A synthetic alcohol derived exclusively from commercial high-pressure petrochemical cracking.

65. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Lignocellulosic by-products (like cereal straws and fruit peels) require pretreatment before fermentation into bioethanol.
Reason (R): Pretreatment disrupts the complex lignin-hemicellulose-cellulose matrix, making cellulose accessible to cellulase enzymes for saccharification.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

66. A biorefinery aims to produce bioethanol from apple pomace. To maximize the bioethanol yield, which of the following combinations of processes should be applied competently?
(A) Direct distillation followed by hexane extraction
(B) Supercritical fluid extraction followed by spray drying
(C) Extrusion cooking followed by lipid saponification
(D) Enzymatic saccharification followed by yeast fermentation

NODIA

67. Identify the incorrect pair regarding the generation of biofuels from food industry by-products:
(A) Fourth-generation biofuels – Produced directly from rendering plant animal fats via transesterification
(B) First-generation biofuels – Produced from edible food crops like corn starch or sugarcane
(C) Second-generation biofuels – Produced from non-food lignocellulosic biomass or agricultural residues
(D) Third-generation biofuels – Produced from aquatic microalgae and macroalgae feedstocks

68. Match the waste streams/biomass in List I with their suitable value-added products in List II:
List I: (Waste Stream/Biomass)
P. Used cooking oil
Q. Potato peels (Starch-rich)
R. Crustacean shells
S. Dairy effluent
List II: (Suitable Value-Added Product)
I. Bioethanol
II. Biodiesel (via transesterification)
III. Biogas (via anaerobic digestion)
IV. Chitosan
(A) P-II, Q-I, R-IV, S-III
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-III, R-I, S-IV
(D) P-III, Q-I, R-IV, S-II

69. Which of the following is NOT a typical inhibitory compound formed during the harsh acid pretreatment of lignocellulosic biomass for bioethanol production?
(A) Lactic acid
(B) Furfural
(C) Hydroxymethylfurfural (HMF)
(D) Acetic acid

70. Identify the correct pair regarding anaerobic digestion of food industry effluents:
(A) Acidogenesis stage – Direct chemical conversion of volatile fatty acids into methane gas
(B) Acetogenesis stage – Direct biological polymerization of simple sugars into cellulose
(C) Methanogenesis stage – Complete breakdown of stable lipids into long-chain fatty acids
(D) Hydrolysis stage – Extracellular breakdown of complex organics into simple monomers

tissue
(B) Bran – The extracted oil fraction of a cereal grain
(C) Pomace – The solid remains of fruit after pressing
(D) Permeate – The solid residue left after oilseed crushing

41. Read the following statements and identify the correct option:
Statement I: Phytic acid, present in high amounts in cereal brans, is considered an anti-nutritional factor because it chelates divalent minerals like iron and zinc.
Statement II: Fermentation or dough leavening with yeast can reduce the phytic acid content due to the action of phytase enzymes.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

42. A batch of groundnut meal intended for human food supplementation is rejected by quality control. Laboratory analysis reveals a high level of a toxic, carcinogenic compound produced by Aspergillus flavus. What is this specific contaminant?
(A) Aflatoxin
(B) Solanine
(C) Patulin
(D) Ochratoxin A

43. Arrange the traditional mechanical/solvent extraction sequence for oilseeds in the correct order:
1. Flaking/Conditioning
2. Cleaning and Dehulling
3. Solvent extraction of the cake
4. Desolventizing the meal
5. Mechanical pre-pressing

(A) 2, 1, 5, 3, 4
(B) 1, 2, 3, 5, 4
(C) 2, 5, 1, 3, 4
(D) 5, 2, 1, 4, 3

44. Which of the following statements about meat processing by-products is incorrect?
(A) Rendering is a process that converts waste animal tissue into stable, usable materials like tallow and meat-and-bone meal.
(B) Mechanically separated meat (MSM) is strictly banned from use in any processed meat products like hot dogs or sausages.`
(C) Blood collected from slaughterhouses can be centrifuged to separate plasma and red blood cells for food applications.
(D) Feathers from poultry processing are often hydrolyzed to produce feather meal, a protein source for animal feed.

45. What is the cause-and-effect relationship regarding the application of heat during the desolventizing-toasting phase of soy meal processing?
(A) Cause: Heating; Effect: Trypsin inhibitor denaturation, improving protein digestibility.
(B) Cause: High thermal exposure; Effect: Immediate activation of lipase, increasing rancidity.
(C) Cause: Prolonged roasting; Effect: Complete conversion of proteins into essential fatty acids.
(D) Cause: Intensive steaming; Effect: Significant enhancement of gossypol chemical toxicity.

46. What is the primary precursor material utilized for the commercial extraction of gelatin?
(A) Keratin from poultry feathers
(B) Elastin from animal blood vessels
(C) Collagen from animal bones and hides
(D) Myosin from skeletal muscle fibers

47. Consider the following statements regarding collagen peptides (hydrolyzed collagen):
1. They are produced by the enzymatic hydrolysis of gelatin or collagen.
2. They form strong, thermoreversible gels at room temperature.
3. They are highly soluble in cold water.
4. They are extensively used in functional foods for joint and skin health.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, 3, and 4

48. Which of the following statements correctly differentiates Type A and Type B gelatin?
(A) Type A is exclusively sourced from fish skin, whereas Type B is sourced from porcine

Click Here to Buy book on Amazon

Which of the above statement(s) is/are correct?
(A) 1, 2, and 3
(B) 1, 2, and 4
(C) 2, 3, and 4
(D) 1, 3, and 4

33. Which of the following statements correctly identifies a key advantage of physical refining over chemical refining for rice bran oil?
(A) Physical refining utilizes high amounts of sodium hydroxide, completely preserving oryzanol content.
(B) Physical refining uses steam distillation to remove free fatty acids, reducing oil loss.
(C) Physical refining does not require a secondary bleaching step, making the oil completely colorless.
(D) Physical refining operates at low ambient temperature, completely preventing any lipid oxidation.

34. In the anatomy of cereal grains, the aleurone layer is best defined as:
(A) The innermost storage region of the endosperm, consisting entirely of highly packed starch granules.
(B) The protective fibrous outer husk that is completely indigestible and lacking in any basic nutrients.
(C) The lipid-rich germ portion of the cereal grain that actively sprouts during the germination process.
(D) The outermost layer of the endosperm, removed with the bran, rich in proteins and lipids.

35. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Defatted soy meal is widely used in the production of textured vegetable protein (TVP) and meat analogs.
Reason (R): Defatted soy meal has a very low protein content, allowing it to easily absorb water and mimic meat texture.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

36. An engineer is designing an extraction protocol to maximize oil yield from sunflower seeds while obtaining a high-quality protein meal. Which process sequence represents the most competent industrial approach?
(A) Chemical solvent extraction followed by direct cold-pressing of the defatted meal
(B) Boiling the crushed seeds in water followed by standard centrifugal separation
(C) Mechanical prepressing followed by solvent extraction of the press cake
(D) Supercritical fluid extraction applied exclusively to whole unhulled seeds

37. Identify the incorrect pair regarding oilseed meals and their characteristic anti-nutritional factors:
(A) Groundnut meal – Glucosinolates
(B) Soybean meal – Trypsin inhibitors
(C) Cottonseed meal – Gossypol
(D) Rapeseed/Mustard meal – Erucic acid and Glucosinolates

38. Match the rice bran oil refining steps in List I with their objectives in List II:
List I: (Rice Bran Oil Refining Step)
P. Degumming
Q. Neutralization
R. Bleaching
S. Deodorization
List II: (Objective)
I. Removal of free fatty acids as soapstock
II. Removal of volatile odoriferous compounds and off-flavors
III. Removal of phosphatides/phospholipids
IV. Removal of pigments using activated earth
(A) P-III, Q-I, R-IV, S-II
(B) P-I, Q-III, R-II, S-IV
(C) P-III, Q-IV, R-I, S-II
(D) P-IV, Q-I, R-III, S-II

39. Which of the following is NOT an application of defatted oilseed meals in the food industry?
(A) Production of protein isolates and concentrates
(B) Extraction of high-value essential oils for perfumery
(C) Fortification of bakery products to enhance protein profile
(D) Preparation of protein hydrolysates for flavor enhancement

40. Identify the correct pair regarding cereal and oilseed by-product terminology:
(A) Germ – The carbohydrate-rich endosperm

NODIA

high-protein feed ingredient in aquaculture and poultry diets.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

57. A processing facility produces fish oil from tuna heads and eyes. The crude oil obtained is highly prone to rapid oxidation. What is the most critical immediate post-extraction step to ensure the stability of the Omega-3 polyunsaturated fatty acids (PUFAs)?
(A) Prolonged high-temperature heating at 150°C to pasteurize the crude oil
(B) Rapid emulsification of the oil with water to form a stable protective interface
(C) Thoroughly bleaching the oil with activated carbon under direct solar exposure
(D) Addition of antioxidants like tocopherols or BHT and storage under inert gas

58. When evaluating the quality of gelatin extracted from fish skins compared to mammalian gelatin, what conceptual difference must a technologist account for in functional food applications?
(A) Fish gelatin has lower gelling and melting points due to low hydroxyproline.
(B) Fish gelatin strictly lacks the essential structural amino acid glycine.
(C) Fish gelatin forms significantly stronger gels at high temperatures than bovine gelatin.
(D) Fish gelatin requires prolonged boiling in concentrated sulfuric acid to fully dissolve.

59. Which of the following statements about collagen peptides is incorrect?
(A) They have very low molecular weights, typically ranging from 2,000 to 5,000 Daltons.
(B) They are rich in tryptophan, making them a complete dietary protein source.
(C) They are completely incapable of forming stable thermoreversible gels at any temperature.
(D) They possess an exceptionally high concentration of glycine, proline, and hydroxyproline.

60. What is the cause-and-effect relationship regarding the use of formic acid in the production of fish silage?
(A) Cause: Addition of formic acid increases the pH; Effect: It solidifies the fish proteins into a hard cake.
(B) Cause: Formic acid lowers pH; Effect: Prevents spoilage while letting enzymes liquefy the tissue.
(C) Cause: Formic acid reacts directly with fish oil; Effect: It converts unsaturated fats into saturated fats.
(D) Cause: Formic acid chelates toxic heavy metals; Effect: It completely removes mercury from the fish tissue.

61. What are the two primary long-chain Omega-3 polyunsaturated fatty acids extracted from marine by-products?
(A) Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA)
(B) Linoleic essential fatty acid and Alpha-linolenic acid (ALA)
(C) Monounsaturated oleic acid and saturated palmitoleic acid
(D) Omega-6 arachidonic acid (ARA) and saturated stearic acid

62. Consider the following statements regarding the concentration of Omega-3 fatty acids from fish oil:
1. Urea complexation is used to separate saturated and monounsaturated fatty acids from polyunsaturated fatty acids.
2. Short-path molecular distillation can concentrate EPA and DHA due to differences in boiling points under high vacuum.
3. Supercritical fluid extraction is ineffective for lipid separation and cannot be used for fish oil.
4. Enzymatic methods using specific lipases can selectively concentrate Omega-3 fatty acids.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

63. Which of the following accurately describes the concept of a "biorefinery" in the context of the food industry?
(A) A waste treatment facility that strictly

Downloaded from www.pdf.tube

CHAPTER 20

By Product Utilisation of Food Industry

1. The term "by-product" in the food processing industry is most accurately defined as which of the following?
(A) The primary finished product manufactured specifically for retail sale and consumption
(B) A secondary product obtained from a manufacturing process or chemical reaction
(C) Material that is completely devoid of economic value and intended for landfilling
(D) Hazardous waste that requires specialized toxic disposal and handling protocols

2. Consider the following statements regarding the importance of by-product utilisation in the food industry:
1. It reduces environmental pollution and biological oxygen demand (BOD) of food industry effluents.
2. It increases the overall production cost without any economic return.
3. It provides a source of functional ingredients and bioactive compounds.
4. It aligns with the principles of a circular economy.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 3
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, 3, and 4

3. Which of the following statements correctly describes the composition of whey?
(A) It contains lactose, proteins, minerals, and water-soluble vitamins.
(B) It consists primarily of insoluble casein proteins and milk fat globules.
(C) It is a rich source of complex structural carbohydrates and dietary fiber.
(D) It is composed almost entirely of isolated alpha-lactalbumin and pure water.

4. In the context of dairy processing, what is "whey permeate"?
(A) The protein-rich retentate obtained after ultrafiltration of cheese whey
(B) The coagulated precipitate formed after the thermal denaturation of proteins
(C) The liquid permeate containing mostly lactose, minerals, and water
(D) The crystallized sugar isolated after enzymatic hydrolysis of whole milk

5. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Whey proteins have a high biological value and are widely used in sports nutrition.
Reason (R): Whey proteins are rich in branched-chain amino acids (BCAAs) such as leucine, isoleucine, and valine.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

6. A dairy plant wants to separate whey into a high-protein fraction and a lactose-rich fraction. Which membrane processing technology is the most competent method for this primary separation?
(A) Microfiltration
(B) Reverse Osmosis
(C) Electrodialysis
(D) Ultrafiltration

NODIA

7. Identify the incorrect pair regarding fruit and vegetable by-products and their major bioactive components:
(A) Apple pomace – Pectin
(B) Grape seeds – Glucosinolates
(C) Tomato pomace – Lycopene
(D) Citrus peel – Essential oils and flavonoids

8. Match the whey derivatives in List I with their primary applications/characteristics in List II:
List I: (Whey Derivatives)
P. Whey Protein Isolate (WPI)
Q. Demineralized Whey
R. Lactose

71. Read the following statements and identify the correct option:
Statement I: Biogas generated from food industry effluents primarily consists of methane (CH_4) and carbon dioxide (CO_2).
Statement II: The methanogenic archaea responsible for biogas production are highly sensitive to oxygen and thrive strictly in anaerobic environments.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

72. During the anaerobic digestion of high-protein slaughterhouse waste for biogas production, the system experiences a sudden drop in methane yield and an increase in pH. What is the most likely cause of this operational failure?
(A) Accumulation of volatile fatty acids causing severe chemical acidification
(B) Complete depletion of gaseous carbon dioxide in the reactor headspace
(C) Ammonia toxicity from protein degradation, inhibiting methanogens
(D) Severe biological contamination of the digester with fermentative yeasts

73. Arrange the typical steps involved in the anaerobic digestion process for biogas production in sequential order:
1. Methanogenesis
2. Hydrolysis
3. Acetogenesis
4. Acidogenesis
(A) 2, 4, 3, 1
(B) 2, 3, 4, 1
(C) 4, 2, 3, 1
(D) 1, 3, 4, 2

74. Which of the following statements about chitin and chitosan is incorrect?
(A) Chitosan is the completely acetylated, water-insolidation derivative of chitin.
(B) Chitin is a structural polysaccharide predominantly found in the exoskeletons of crustaceans.
(C) Chitosan possesses inherent antimicrobial and film-forming properties.
(D) Industrial extraction of chitin involves demineralization with acid and deproteinization with alkali.

75. What is the cause-and-effect relationship involved in the conversion of chitin to chitosan?
(A) Treatment with hot concentrated hydrochloric acid; Effect: Complete hydrolysis into free glucose molecules.
(B) Treatment with hot alkali; Effect: Polymer deacetylation, enabling solubility in dilute acids.
(C) Enzymatic chemical cross-linking with transglutaminase; Effect: Direct formation of an indigestible plastic.
(D) Bleaching treatment with concentrated hydrogen peroxide; Effect: Addition of acetyl groups to the polymer chain.

76. What is the major abundant organic material recovered as a solid by-product from the brewing industry (mashing stage)?
(A) Spent hops
(B) Brewer's Spent Grain (BSG)
(C) Surplus brewing yeast
(D) Trub

77. Consider the following statements regarding Brewer's Spent Grain (BSG):
1. It is rich in dietary fiber (cellulose, hemicellulose, lignin) and protein.
2. It has a very low moisture content immediately after the mashing process, making it highly stable.
3. It can be utilized as ruminant animal feed.
4. It is increasingly being upcycled into flours for high-fiber baked goods.
Which of the above statement(s) is/are correct?
(A) 1, 2, and 3
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, 4

78. Which of the following statements correctly describes a utilization pathway for spent coffee grounds (SCG)?
(A) SCG are predominantly composed of simple sugars, making them ideal for clear beverage formulation.
(B) SCG are strictly prohibited from being composted due to extreme heavy metal toxicity.
(C) SCG can be processed to extract coffee oil

Click Here to Buy book on Amazon

plastic food packaging into new structural materials.
(B) Artificial methods used for elevating the retail price of premium and organic food products.
(C) Creating high-value products from food by-products that would otherwise be wasted.
(D) Utilizing organic food waste streams solely for commercial anaerobic digester applications.

95. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Enzyme-assisted extraction is often preferred over conventional solvent extraction for recovering bioactives from plant by-products.
Reason (R): Enzymes like cellulase and pectinase help break down the plant cell wall, facilitating higher mass transfer and release of intracellular bioactives.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

96. A dairy cooperative is evaluating what to do with excess cheese whey. To maximize economic return and produce a human-grade functional ingredient, which process should the food technologist recommend?
(A) Spreading raw liquid cheese whey directly onto agricultural fields as a soil fertilizer
(B) Anaerobic fermentation of raw whey in open lagoons to generate commercial biogas energy
(C) Using ultrafiltration to produce Whey Protein Concentrate (WPC)
(D) Neutralizing the acidic whey with lime and directly discharging it into municipal sewers

97. Identify the incorrect pair related to food industry wastes and their common upcycled applications:
(A) Olive mill wastewater – Recovery of hydroxytyrosol (antioxidant)
(B) Potato peel waste – Extraction of gluten
(C) Onion peels – Extraction of quercetin
(D) Citrus pulp – Extraction of dietary fiber

98. Match the enzymes used in by-product valorisation in List I with their primary actions in List II:
List I: (Enzyme used in By-product Valorisation)
P. Cellulase
Q. Protease
R. Phytase
S. Pectinase
List II: (Primary Action)
I. Hydrolyzes proteins in fish waste to produce silage
II. Degrades phytic acid in cereal brans to improve mineral bioavailability
III. Breaks down plant cell walls to release bound polyphenols
IV. Facilitates the clarification of fruit juices and extraction of peel bioactives
(A) P-III, Q-I, R-II, S-IV
(B) P-I, Q-II, R-III, S-IV
(C) P-IV, Q-I, R-II, S-III
(D) P-III, Q-IV, R-I, S-II

99. Which of the following is NOT an advantage of utilizing supercritical CO_2 for the extraction of functional lipids (like Omega-3) from by-products?
(A) It requires the use of highly toxic organic co-solvents to function.
(B) It operates at low temperatures, preserving heat-sensitive compounds.
(C) The solvent (CO_2) is easily removed by depressurization, leaving no residue.
(D) It provides a highly pure extract suitable for food and pharmaceutical applications.

100. Identify the correct pair regarding the conversion of starch-rich by-products to bioethanol:
(A) Saccharification – Complete biological conversion of simple hexose sugars to ethanol by yeast
(B) Fermentation – Industrial use of highly purified glucoamylase enzyme to form free glucose
(C) Liquefaction – α-amylase breakdown of gelatinized starch to dextrins
(D) Distillation – Mechanical processes involved in the initial breakdown of plant cell walls

101. Read the following statements and identify the correct option:
Statement I: Distillers Dried Grains with Solubles (DDGS) is a major co-product of the bioethanol industry.

NODIA

within safe limits.
Statement II: The circular economy model in the food industry advocates for "take-make-dispose" linear production.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

87. A company successfully extracts a novel antioxidant from mango seed kernels and wishes to market it as a food additive in India. Under FSSAI regulations, what regulatory pathway must be primarily addressed before commercialization?
(A) Immediate commercial retail distribution under the Meat and Poultry Products Order
(B) Approval under the FSSAI Non-Specified Food and Food Ingredients Regulations
(C) Direct registration strictly as a traditional Ayurvedic drug under the AYUSH ministry
(D) Official declaration of the extract as a standard synthetic flavor under commodities

88. The food industry is shifting from a linear economy to a circular economy. Which of the following practices best exemplifies "valorisation" within a circular economy framework?
(A) Sending organic citrus peels to a specialized regional municipal landfill
(B) Incinerating liquid cheese whey to reduce the overall factory carbon footprint
(C) Extracting pectin from citrus peels for use in commercial jams
(D) Diluting raw dairy effluents with fresh tap water to meet discharge standards

89. Which of the following statements concerning the Life Cycle Assessment (LCA) of by-product valorisation is incorrect?
(A) LCA comprehensively evaluates the environmental impacts of a product from cradle to grave.
(B) Drying high-moisture by-products often negatively impacts the LCA due to high energy consumption.
(C) LCA helps identify trade-offs, such as replacing synthetic chemicals with bio-based ones.
(D) Valorisation guarantees a lower footprint regardless of energy intensity.

NODIA

90. What is the primary cause-and-effect relationship associated with applying circular economy principles to food processing?
(A) Cause: Minimizing waste and recovering value; Effect: Enhanced resource efficiency.
(B) Cause: Promoting single-use plastic packaging for by-products; Effect: Reduction in ocean plastics.
(C) Cause: Direct discarding of raw agricultural residues in rivers; Effect: Increased aquatic biodiversity.
(D) Cause: Industrial over-extraction of primary raw materials; Effect: Sustainable economic growth.

91. What is the primary functional property of pectin in the food industry?
(A) Emulsifier for oil-in-water emulsions
(B) Gelling and thickening agent
(C) Synthetic colorant
(D) High-intensity non-nutritive sweetener

92. Consider the following statements regarding the extraction of astaxanthin:
1. It is a highly valued pink/red pigment.
2. It can be recovered from crustacean shell waste.
3. It exhibits potent antioxidant properties.
4. It is highly soluble in water and poorly soluble in lipids.
Which of the above statement(s) is/are correct?
(A) 1, 2, and 3
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 4

93. Which statement correctly identifies a key component of tea processing by-products?
(A) Tea seed oil, rich in unsaturated fatty acids, is used as edible oil.
(B) Spent tea leaves are composed almost entirely of plant-derived gluten proteins.
(C) Tea waste contains zero polyphenols, which are completely removed during brewing.
(D) Tea fluff by-products are primarily processed into high-protein animal feed.

94. "Upcycling" in the food industry is most precisely defined as:
(A) The physical process of recycling single-use

124. "Stickwater" in the fish processing industry is best defined as:
(A) The high-volume chemical wastewater stream and pure water used to wash the processing factory floors.
(B) The liquid byproduct from pressing cooked fish, containing soluble proteins and residual oil.
(C) The heavy organic chemical solvent used as a processing aid to extract Omega-3 fatty acids.
(D) The saturated sodium chloride brine solution used exclusively for packing canned industrial tuna.

125. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): The incorporation of wheat bran into refined flour formulations decreases the glycemic index of the resulting food product.
Reason (R): The dietary fiber in wheat bran slows down gastric emptying and the intestinal absorption of digestible carbohydrates.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

126. An entrepreneur wishes to extract high-quality, undenatured whey protein isolate (WPI) from cheese whey. Which technological sequence ensures the retention of the protein's native functional properties (e.g., foaming and gelation)?
(A) Extreme thermal boiling under pressure followed by isoelectric mineral precipitation
(B) Direct addition of concentrated sulfuric acid followed by industrial drum drying techniques
(C) Microfiltration (to defat) followed by ultrafiltration and low-temperature spray drying
(D) Complete enzymatic hydrolysis using active proteases followed by industrial freeze-drying

127. Identify the incorrect pair regarding the physiological effects or properties of specific bioactives from by-products:
(A) Anthocyanins (Grape pomace) – Act as dual-function natural antioxidant and colorant
(B) γ-Oryzanol (Rice bran) – Promotes clinically significant cholesterol reduction
(C) EPA/DHA (Fish oil) – Provides potent anti-inflammatory and cardiovascular benefits
(D) Pectin (Apple pomace) – Direct increase in postprandial glucose spikes

128. Match the processing wastes in List I with their specific value-added components in List II:
List I: (Processing Waste)
P. Whey permeate
Q. Apple pomace
R. Shrimp shells
S. Soy molasses
List II: (Specific Value-Added Component)
I. Isoflavones and soy oligosaccharides
II. Astaxanthin and Chitin
III. Malic acid and Pectin
IV. Riboflavin and Lactose
(A) P-IV, Q-III, R-II, S-I
(B) P-III, Q-IV, R-I, S-II
(C) P-I, Q-II, R-III, S-IV
(D) P-IV, Q-II, R-III, S-I

129. Which of the following is NOT a recognized benefit of incorporating defatted groundnut meal into food products?
(A) It significantly increases the protein content of the food.
(B) It acts as a primary source of long-chain Omega-3 fatty acids.
(C) It improves the water and oil binding capacities in processed meats.
(D) It provides a cost-effective plant protein alternative to animal proteins.

130. Identify the correct pair regarding the extraction of gelatin from different sources:
(A) Bovine hide – Usually processed using high-pressure hot water extraction with acid pretreatment exclusively
(B) Fish skin – Yields gelatin exhibiting the highest thermal gelling and melting points among all sources
(C) Bovine bone (ossein) – Requires absolutely no chemical demineralization or decalcification prior to extraction
(D) Pig skin – Acid pretreatment (Type A) due to less collagen cross-linking

131. Read the following statements and identify the correct option:
Statement I: The primary purpose of refining rice bran oil is to remove free fatty acids,

Downloaded from www.pdf.tube

Statement II: DDGS is deficient in protein and is primarily utilized as a low-grade fuel for incineration.

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

102. A brewery wishes to convert its residual trub (precipitated proteins and hop residues) into a functional food additive. However, taste panels reject the product due to extreme bitterness. What is the most likely source of this bitterness?
(A) Maillard reaction products
(B) Residual ethanol
(C) Chitin from yeast cell walls
(D) Iso-alpha-acids from hops

103. Arrange the stages of protein extraction from defatted oilseed meal in the correct sequential order:
1. Isoelectric precipitation (lowering pH to ~4.5)
2. Alkaline extraction (solubilizing protein at pH 8-9)
3. Spray drying of the neutralized protein curd
4. Centrifugation to separate insoluble fiber
5. Centrifugation to collect the precipitated protein curd

(A) 2, 4, 1, 5, 3
(B) 1, 2, 4, 5, 3
(C) 2, 1, 4, 5, 3
(D) 4, 2, 1, 3, 5

104. Which of the following statements about the circular economy in food processing is incorrect?
(A) It aims to decouple economic growth from the consumption of finite resources.
(B) It encourages the design of processes that eliminate waste and keep materials in use.
(C) It relies entirely on increasing landfill capacity for biodegradable waste.
(D) It includes strategies such as upcycling, anaerobic digestion, and composting.

105. What is the primary cause-and-effect relationship regarding the over-acidification (souring) of an anaerobic digester processing food industry effluent?

NODIA

(A) Cause: Methanogenic bacteria consume volatile fatty acids too quickly; Effect: pH rises above 8.5, killing acidogens.
(B) Cause: Accidental injection of pure oxygen into the digester; Effect: Rapid chemical conversion of methane to CO_2.
(C) Cause: High concentrations of free lactose in the effluent; Effect: Immediate physical crystallization blocking pipes.
(D) Cause: VFA production exceeds consumption; Effect: pH drop inhibits methanogens, stopping methane.

106. What is the primary structural difference between high methoxyl (HM) pectin and low methoxyl (LM) pectin?
(A) Degree of esterification (DE)
(B) Number of glucose units in the backbone
(C) Presence of amino groups
(D) The type of glycosidic bond (α vs β)

107. Consider the following statements about gelatin bloom strength:
1. Bloom strength is a measure of the firmness of a gelatin gel.
2. A higher Bloom value indicates a stronger gel.
3. High Bloom gelatin is generally preferred for making hard capsules.
4. Low Bloom gelatin is primarily used where high viscosity is desired without strong gelation.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 3
(B) 2, 3, and 4
(C) 1, 2, 3, and 4
(D) 1, 3, and 4

108. Which statement correctly outlines the application of chitosan as a food preservative?
(A) Chitosan completely halts all enzymatic browning reactions in sliced fruits without affecting microbes.
(B) Polycationic chitosan disrupts negatively charged cell membranes of spoilage microbes.
(C) Chitosan acts as a strong synthetic antioxidant that is chemically far more potent than standard BHT.
(D) Chitosan significantly increases the surface water activity of stored foods, preventing desiccation.

109. Defatted soy meal is defined as:

Which of the above statement(s) is/are correct?
(A) 1, 2, and 4
(B) 1, 3, and 4
(C) 2, 3, and 4
(D) 1, 2, and 3

138. Which of the following statements correctly highlights the difference between conventional fish meal and fish protein hydrolysate (FPH)?
(A) FPH is enzymatically broken down into soluble peptides, whereas fish meal contains intact protein.
(B) Fish meal is highly soluble in water, while FPH is completely insoluble and forms stable structural gels.
(C) Fish meal is meant exclusively for high-grade human consumption, while FPH is strictly used as farm fertilizer.
(D) FPH contains high amounts of intact bones and scales, whereas standard fish meal is completely demineralized.

139. How is the "Bloom" of gelatin defined in standard testing?
(A) The precise physical temperature at which a standard 10% gelatin chemical solution turns from clear to cloudy.
(B) The weight in grams required to depress a standard plunger 4 mm into a prepared 6.67% gelatin gel.
(C) The optical visual clarity and percentage light transmittance of a prepared gelatin solution measured at 40°C.
(D) The exact time in minutes taken for a standardized liquid gelatin solution to completely solidify at room temperature.

140. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Lycopene extracted from tomato processing waste is more bioavailable when formulated with a lipid carrier.
Reason (R): Lycopene is a highly lipophilic (fat-soluble) carotenoid, and the presence of dietary lipids enhances its micellarization and intestinal absorption.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

141. A regulatory affairs manager is submitting a dossier to FSSAI for a novel antioxidant extracted from pomegranate peels. To competently prove the economic and safety viability of this by-product ingredient, what key data must be emphasized?
(A) Quantitative analysis of punicalagins, absence of contaminants, and acute toxicity studies
(B) The historical aesthetic appeal and consumer popularity of the original pomegranate fruit
(C) Only the biochemical and sensory profile of the final dried extract when dissolved in pure water
(D) Proof that the extract can completely replace all chemical preservatives in every food category

142. Identify the incorrect pair regarding concepts in waste management and by-product valorisation:
(A) Downcycling – Converting waste into a material of lesser quality or functionality
(B) Upcycling – Converting waste into materials or products of higher environmental value or quality
(C) Composting – Thermal recovery of energy via direct combustion
(D) Bioremediation – Using microorganisms to break down environmental pollutants

143. Match the circular economy concepts in List I with their food industry examples in List II:
List I: (Circular Economy Concept)
P. Reduce
Q. Reuse
R. Recycle
S. Recover
List II: (Food Industry Example)
I. Anaeroric digestion of food waste to generate biogas (energy)
II. Processing mis-shaped "ugly" vegetables into a marketable purée
III. Optimizing slicing machinery to minimize physical meat trim
IV. Utilizing returnable glass milk bottles
(A) P-III, Q-IV, R-II, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-III, Q-II, R-IV, S-I
(D) P-IV, Q-III, R-I, S-II

144. Which of the following is NOT a recognized benefit of the biorefinery concept in the food sector?

Click Here to Buy book on Amazon

(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

117. A food safety inspector inspects a facility that produces an edible film from shrimp processing waste. The film is intended to coat fresh fruits to extend shelf life. What is the active polymer in this film, and what is its primary charge in a mildly acidic solution?
(A) Chitosan; positive charge
(B) Pectin; negative charge
(C) Gelatin; neutral charge
(D) Cellulose; negative charge

118. To maximize the economic return of an orange juice processing plant, the management decides to implement a cascade biorefinery approach for the citrus peels. Which logical sequence of extraction maximizes value?
(A) Biogas production → Essential oil extraction → Pectin extraction
(B) Pectin extraction → Composting → Essential oil extraction
(C) Anaerobic digestion → Pectin extraction → Animal feed
(D) Essential oil extraction (cold pressing/ distillation) → Pectin extraction (acid hydrolysis) → Anaerobic digestion of the residue (biogas)

119. Which of the following statements regarding the fermentation of agricultural by-products for bioethanol production is incorrect?
(A) Simultaneous Saccharification and Fermentation (SSF) is an advanced method that combines enzymatic hydrolysis and fermentation in one vessel.
(B) Pentose sugars (like xylose from hemicellulose) are fermented just as rapidly and efficiently as glucose by standard baking yeast.
(C) Hexose sugars like glucose are readily fermented by wild-type Saccharomyces cerevisiae.
(D) Distillation is required post-fermentation to concentrate the ethanol.

120. What is the primary cause-and-effect relationship regarding the refining of crude rice bran oil containing very high levels of free fatty acids (FFA)?
(A) Cause: Wax saturation; Effect: The oil becomes completely solid and cloudy at room temperature.
(B) Cause: Steam deodorization; Effect: Oryzanol concentration increases exponentially during refining.
(C) Cause: High FFA; Effect: Alkaline neutralization causes saponification and high oil loss.
(D) Cause: Bleaching earth absorption; Effect: The oil is rendered highly resistant to thermal oxidation.

NODIA

121. What valuable functional ingredient is widely extracted from the inner peels of citrus fruits (albedo)?
(A) Carrageenan
(B) Agar-agar
(C) Xanthan gum
(D) Pectin

122. Consider the following statements regarding the utilization of lactose recovered from whey permeate:
1. It is used as an excipient or filler in the pharmaceutical industry.
2. It can be enzymatically converted into lactulose, a prebiotic.
3. It has a much higher sweetening power than sucrose.
4. It is utilized in infant milk formulas to mimic the carbohydrate profile of human milk.

Which of the above statement(s) is/are correct?
(A) 1, 2, and 3
(B) 1, 2, and 4
(C) 2, 3, and 4
(D) 1, 3, and 4

123. Which of the following correctly describes a practical application of collagen peptides in functional foods?
(A) They are widely used in the confectionery industry to create hard, brittle coatings.
(B) They are added to functional foods to improve joint mobility and skin elasticity.
(C) They are utilized as a direct substitute or replacer for yeast in bread making doughs.
(D) They are chemically employed strictly to lower the active pH of dairy fermentations.

(A) The high-protein residual meal left after solvent extraction of soybean oil.
(B) The oil-rich fraction of soybeans obtained after intensive mechanical press operations.
(C) Soy protein isolate that has been completely hydrolyzed into small molecular weight peptides.
(D) The fibrous outer hull fraction removed from whole soybean seeds before the cracking stage.

110. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Winterization is a critical step in the refining of marine oils (fish oil).
Reason (R): Winterization removes high-melting-point triglycerides (stearins) that would cause the oil to become cloudy under refrigeration.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

111. When developing a clear, fortified functional water containing Omega-3 fatty acids from fish oil, which technological approach competently resolves the issues of water-insolubility and potential fishy off-flavors?
(A) Directly dispersing the crude unrefined fish oil using standard high-shear mixing equipment
(B) Adding massive quantities of synthetic chemical emulsifiers and boiling the final mixture
(C) Converting the marine fish oil entirely into free fatty acids via enzymatic lipolysis processes
(D) Microencapsulating the oil using a hydrophilic wall material like modified starch

112. Identify the incorrect pair regarding plant by-products and their upcycled usage:
(A) Cocoa pods – Potash fertilizer and activated carbon
(B) Coconut coir – Hydroponic growing medium
(C) Soybean hulls – High-value commercial pectin extraction
(D) Apple pomace – Substrate for solid-state fermentation to produce enzymes

113. Match the microorganisms/biological agents in List I with their roles in waste valorisation in List II:
List I: (Microorganism/Biological Agent)
P. Saccharomyces cerevisiae
Q. Lactic acid bacteria
R. Aspergillus niger
S. Methanogenic archaea
List II: (Role in Waste Valorisation)
I. Biogas production in anaerobic digestion
II. Bioethanol fermentation from hexose sugars
III. Preservation of fish silage via pH reduction
IV. Solid-state fermentation of pomace for citric acid
(A) P-II, Q-III, R-IV, S-I
(B) P-I, Q-II, R-III, S-IV
(C) P-II, Q-IV, R-III, S-I
(D) P-III, Q-II, R-I, S-IV

114. Which of the following is NOT typically a property of dietary fiber derived from cereal bran?
(A) Increases fecal bulk and reduces transit time
(B) Binds water and increases dough absorption in baking
(C) Can impart a dark color and coarse texture to baked goods
(D) Highly digestible by human pancreatic amylase

115. Identify the correct pair regarding the structural components of cereal grains and their recovery:
(A) Germ – Recovered for oil extraction due to lipid and vitamin E content
(B) Endosperm – Pure structural starch tissue recovered as coarse bran particles
(C) Husk – Extremely fibrous outer layer ground to produce white refined flour
(D) Aleurone – Protein-rich cell layer completely devoid of vitamins and minerals

116. Read the following statements and identify the correct option:
Statement I: Mechanically deboned meat (MDM) is a paste-like meat product produced by forcing puréed or ground beef, pork, turkey or chicken under high pressure through a sieve or similar device.
Statement II: MDM is typically higher in calcium content than intact muscle meat due to the incorporation of microscopic bone particles.
(A) Both Statement I and Statement II are correct.

Downloaded from www.pdf.tube

unsaponifiable matter, waxes, and odoriferous compounds.

Statement II: Dewaxing of rice bran oil is achieved by chilling the oil to crystallize the waxes, followed by filtration or centrifugation.

(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

132. A commercial baker formulates a high-fiber bread using 20% brewer's spent grain (BSG). After baking, the bread exhibits a dense crumb and poor volume. As a technologist, how would you best resolve this issue while maintaining the 20% BSG level?

(A) Significantly increase the baking time by up to 3 hours to evaporate excess moisture.
(B) Completely replace all biological yeast with high concentrations of chemical baking powder.
(C) Add vital wheat gluten and ascorbic acid to strengthen the gluten network.
(D) Ferment the BSG with active lactic acid bacteria cultures for several weeks to dissolve fiber.

133. Arrange the typical extraction sequence for recovering collagen peptides from animal hides:

1. Enzymatic hydrolysis of the extracted gelatin
2. Hot water extraction of gelatin
3. Washing and mincing of the hide
4. Filtration and spray drying of the peptide solution
5. Pretreatment (acid or alkaline swelling)

(A) 3, 5, 2, 1, 4
(B) 5, 3, 2, 1, 4
(C) 3, 2, 5, 4, 1
(D) 2, 3, 5, 1, 4

134. Which of the following statements regarding the economic viability of by-product valorisation is incorrect?

(A) Economies of scale play a crucial role; small volumes of by-products may not justify the capital expenditure for extraction equipment.
(B) The cost of drying wet by-products often exceeds the market value of the extracted low-value compounds.
(C) Establishing stable supply chains for seasonal by-products is a major economic challenge.
(D) Transportation costs are negligible because food wastes have an extremely high bulk density and low moisture.

135. What is the cause-and-effect relationship of establishing a "Zero Liquid Discharge" (ZLD) system in a food processing plant?

(A) Cause: Discharging untreated effluent directly into local rivers; Effect: Avoidance of all regulatory fines.
(B) Cause: Wastewater recycling; Effect: Elimination of liquid effluent discharge to the environment.
(C) Cause: High-temperature evaporation of all solid waste; Effect: Increased commercial production of bioethanol.
(D) Cause: Diluting effluent with fresh municipal tap water; Effect: Reduced biological oxygen demand at source.

136. In the context of the food industry, the core principle of the "Circular Economy" is to:

(A) Aggressively maximize the total factory throughput of single-use fossil-based packaging materials.
(B) Ensure all commercial retail food products are packaged strictly using circular paper containers.
(C) Transition from a linear model to continuously loop resources back into the value chain.
(D) Promote the rapid planned obsolescence of heavy food processing and packaging machinery.

NODIA

137. Consider the following statements about the regulatory approval of by-products as food ingredients in India (FSSAI):

1. Any newly extracted compound without a history of consumption must be approved as a "Novel Food".
2. Safety data, including toxicity and allergenicity studies, are strictly required for novel extracts.
3. Once approved in the US (FDA GRAS), a novel ingredient is automatically exempt from FSSAI approval in India.
4. Maximum residue limits (MRLs) for extraction solvents (e.g., hexane) are strictly regulated in the final ingredient.

for use in cosmetics and biodiesel.
(D) SCG yield a pure white, highly soluble protein isolate comparable to dairy whey protein.

79. Composting of food industry solid waste is defined as:
(A) The anaerobic biological putrefaction of organic waste producing highly toxic chemical leachates.
(B) The thermal destruction of waste in the absolute absence of oxygen to produce liquid bio-oil.
(C) The commercial chemical neutralization of hazardous acidic effluents using alkaline quicklime.
(D) The controlled aerobic biological decomposition of organic matter into stable humus.

80. Identify the correct option based on the following Assertion (A) and Reason (R):
Assertion (A): Wet brewer's spent grain must be dried or utilized rapidly within 48 hours of production.
Reason (R): It has a high moisture content (70-80%) and is rich in nutrients, making it highly susceptible to rapid microbial spoilage.
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

81. A food scientist wants to utilize tea waste (tea fluff) generated from a processing factory. Which high-value compound is most competently and commonly targeted for extraction from this specific by-product before it is composted?
(A) Lycopene
(B) Caffeine
(C) Pectin
(D) Chitin

82. Identify the incorrect pair regarding coffee and tea processing by-products:
(A) Coffee cascara – Dried skins and pulp of coffee cherries used for brewing beverages
(B) Tea fluff – Fiber and stem waste generated during black tea grading
(C) Coffee silverskin – The innermost skin of the coffee bean removed during roasting
(D) Spent tea leaves – A highly concentrated source of pure starch used for edible films

83. Match the crustacean processing steps in List I with their chemical agents used in List II:
List I: (Crustacean Processing Step)
P. Deproteinization
Q. Demineralization
R. Decoloration/Bleaching
S. Deacetylation
List II: (Chemical Agent Used)
I. Dilute Hydrochloric Acid (HCl)
II. Concentrated Sodium Hydroxide (NaOH) with heat
III. Dilute Sodium Hydroxide (NaOH)
IV. Hydrogen Peroxide or Acetone
(A) P-III, Q-I, R-IV, S-II
(B) P-I, Q-III, R-II, S-IV
(C) P-III, Q-II, R-I, S-IV
(D) P-II, Q-I, R-IV, S-III

84. Which of the following is NOT considered a barrier to the economic viability of by-product valorisation in the food industry?
(A) High moisture content of by-products increasing transport and drying costs
(B) Seasonal availability of certain raw materials (e.g., fruit pomace)
(C) The extremely low biological oxygen demand (BOD) of food wastes
(D) Stringent regulatory approvals required for novel food ingredients

85. Identify the correct pair regarding the regulatory aspect of upcycled foods:
(A) GRAS – Generally Recognized As Safe (a regulatory designation for ingredients)
(B) Novel Food – A food ingredient that has a long history of safe consumption since the 1800s
(C) Upcycled Food – Food destined for human consumption that has been chemically altered into a petrochemical
(D) FSSAI Schedule IV – Regulations explicitly banning the use of all agricultural by-products

86. Read the following statements and identify the correct option:
Statement I: Incorporating upcycled food ingredients, such as defatted seed meals, into new food formulations often requires toxicological assessment to ensure anti-nutritional factors are

Click Here to Buy book on Amazon

(A) Diversification of the income streams for food processing plants
(B) Reduction of waste disposal costs and environmental penalties
(C) Complete elimination of the need for any primary agricultural crops
(D) Production of bio-based chemicals to replace fossil-derived counterparts

145. Identify the correct pair regarding enzymes used in by-product valorisation and their substrates:
(A) Pectinase – Fish scales
(B) Keratinase – Poultry feathers
(C) Lipase – Wheat bran hemicellulose
(D) Cellulase – Cheese whey

146. Read the following statements and identify the correct option:
Statement I: The extraction of hesperidin, a bioactive flavonoid, is predominantly carried out using citrus peel waste.
Statement II: Hesperidin is highly soluble in cold water, making its extraction simple without the need for alkaline conditions or organic solvents.
(A) Both Statement I and Statement II are correct.
(B) Both Statement I and Statement II are incorrect.
(C) Statement I is correct but Statement II is incorrect.
(D) Statement I is incorrect but Statement II is correct.

147. A large-scale juicing operation produces hundreds of tons of carrot pomace weekly. Which cascade utilization strategy is best suited to extract value while adhering to circular economy principles?
(A) Extract β-carotene → dry residues for fiber supplements → compost remainder.
(B) Directly incinerate the high-moisture wet pomace to generate steam for factory heating.
(C) Mix the raw pomace with active chlorine bleach to sanitize it → dump into a municipal landfill.
(D) Attempt to ferment the raw pomace directly into a clear alcoholic beverage without adding enzymes.

148. The Food Safety and Standards (Packaging) Regulations stipulate restrictions on packaging migration. If a company develops an edible, biodegradable packaging film from shrimp shell chitosan to replace plastic, what specific allergen warning MUST be prominently displayed on the final food product if it coats a non-seafood item?
(A) Contains active wheat gluten proteins
(B) Contains allergenic dairy or milk solids
(C) May contain crustacean derivatives
(D) Contains soy or legume allergen components

149. Which of the following statements comparing a linear economy to a circular economy in food processing is incorrect?
(A) A linear economy promotes the maximum extraction of value from every kg of raw material input.
(B) Linear economies follow a "take, make, dispose" model, treating by-products as waste.
(C) Circular economies focus on closing the loop, turning waste streams into raw materials for other processes.
(D) By-product valorisation is a fundamental pillar of transitioning from a linear to a circular economy.

150. What is the primary cause-and-effect relationship regarding the presence of anti-nutritional factors (e.g., glucosinolates) in rapeseed/mustard meal when used for animal feed?
(A) Cause: High glucosinolate content; Effect: Improved protein digestibility and rapid weight gain in monogastric animals.
(B) Cause: Glucosinolates react with gastrointestinal water; Effect: They form highly stable, digestible vitamins.
(C) Thermal degradation of glucosinolates; Effect: Complete conversion of the meal into a pure carbohydrate source.
(D) Cause: Glucosinolates; Effect: Interference with thyroid function and reduced feed palatability.

www.nodia.in

Downloaded from www.pdf.tube

19. (A) Lipid-soluble pigments responsible for yellow, orange, and red colors.
Carotenoids are lipid-soluble, highly hydrophobic tetraterpenoid pigments widely distributed in vegetable by-products like carrot pomace. They are responsible for vibrant yellow, orange, and red hues in nature. In the food industry, these pigments are valued as natural colorants and provitamin A sources, and they function as highly efficient antioxidants due to their conjugated double-bond systems.

20. (C) A is true but R is false.
Apple pomace is widely processed to manufacture commercial dietary fiber supplements because it is rich in structural polysaccharides, including cellulose, hemicellulose, and pectin. Simple sugars are easily washed away during processing, leaving behind this insoluble and soluble fiber matrix. Therefore, the claim that apple pomace has negligible cellulose and hemicellulose is completely false.

21. (A) Hexane or ethyl acetate solvents
Lycopene is a highly lipophilic, non-polar carotenoid pigment that is completely insoluble in water. Consequently, polar solvent systems like pure water or dilute acids are highly ineffective for its recovery. Non-polar or moderately polar organic solvents, such as hexane or ethyl acetate, are required to solubilize and efficiently extract lycopene from tomato pomace.

22. (D) Citrus seeds – High concentration of amylose and amylopectin
Citrus seeds do not contain high concentrations of starch polymers like amylose and amylopectin. Instead, they are characterized by their high lipid content, bitter limonoids, and proteins. Other seeds are correctly matched with their major extracts: grape seeds provide proanthocyanidins, papaya seeds yield benzyl isothiocyanate, and mango kernels contain high-quality fat suitable as a cocoa butter equivalent.

23. (A) P-II, Q-IV, R-I, S-III
Bioactive compounds are characteristically distributed across specific by-product streams. Hesperidin is the primary flavonoid in citrus peels, while resveratrol is a stilbenoid found in grape pomace. Bromelain is a proteolytically active enzyme extracted from pineapple stems and cores. Oleuropein is a bitter phenolic compound recovered from olive mill waste during olive oil production.

24. (C) High-Temperature Destructive Distillation
Advanced extraction techniques like microwave-assisted extraction, pulsed electric fields, and pressurized liquid extraction are designed to improve yield while preserving heat-sensitive polyphenols. In contrast, high-temperature destructive distillation utilizes extreme thermal conditions that cause thermal degradation and pyrolysis, rendering it completely unsuitable for recovering intact, biologically active antioxidant compounds from fruit pomace.

25. (D) Rice bran – Rich source of γ-oryzanol and tocopherols
Rice bran is highly valued as a rich source of gamma-oryzanol, tocopherols, and tocotrienols, which are potent antioxidants with cholesterol-lowering properties. Conversely, wheat bran is primarily a fiber source with low lipid content, oat bran is valued for beta-glucans rather than phytic acid, and corn bran is used as fiber rather than for high fructose syrup production.

26. (C) Statement I is correct but Statement II is incorrect.
Cereal brans are highly concentrated sources of dietary fiber, minerals, and B-vitamins compared to the starchy endosperm. However, incorporating wheat bran into bread dough typically decreases the loaf volume. This reduction occurs because the fibrous particles physically disrupt the gluten network and compete with gluten proteins for water hydration, weakening the dough structure.

NODIA

27. (B) Extrusion cooking or micronization of the rice bran prior to incorporation
Incorporating raw defatted rice bran into bakery formulations often causes gritty textures and poor dough cohesion due to large, rigid fiber particles. Implementing extrusion cooking or micronization reduces the particle size and modifies the fiber structure, which enhances water binding and improves dough integration, successfully mitigating texture issues while maintaining high fiber levels.

28. (B) DPPH radical scavenging spectrophotometric assay
The DPPH radical scavenging assay is a rapid, widely accepted spectrophotometric method in food science based on single electron transfer. It

alpha-lactalbumin, and bovine serum albumin are soluble proteins that remain in the liquid whey phase after coagulation. Therefore, kappa-casein is not classified as a whey protein.

10. (A) Low pH (Acidic) – Hydrolyzes protopectin into soluble pectin
Pectin extraction from apple pomace utilizes low pH conditions to hydrolyze insoluble protopectin, which is bound within plant cell walls, into soluble pectin. This acid-catalyzed hydrolysis must be carefully controlled with respect to temperature and duration to maximize pectin yield while preventing excessive depolymerization and de-esterification, which would impair the final gel-forming properties.

11. (C) Statement I is correct but Statement II is incorrect.
Citrus peels and apple pomace are globally recognized as the primary commercial sources of pectin. However, commercial pectin extraction is carried out under hot, dilute acidic conditions rather than alkaline conditions. Alkaline solutions would cause rapid de-esterification and depolymerization of the pectin backbone, destroying its ability to form stable gels in food applications.

12. (B) Excessive acid hydrolysis during extraction caused severe de-esterification.
High methoxyl pectin requires a high degree of esterification to form gels in the presence of sugar and acid. If the acid hydrolysis stage during extraction is too severe, it causes excessive de-esterification, converting the polymer into low methoxyl pectin. Low methoxyl pectin cannot gel under high-sugar conditions without divalent cations like calcium.

13. (A) 3, 5, 4, 1, 2
Commercial pectin extraction begins by washing and blanching citrus peels to inactivate degradative enzymes. The peels then undergo hot dilute acid extraction to solubilize protopectin. The resulting liquid extract is filtered and concentrated, followed by alcohol precipitation to separate the pectin. Finally, the precipitated pectin is dried and milled into a stable, commercial powder.

14. (C) Banana peels contain too much lignin to be digested at all by ruminant livestock.
Banana peels are highly digestible and valuable sources of nutrients for ruminants, containing significant amounts of soluble carbohydrates, proteins, and essential minerals. While they contain some fiber, they are not completely indigestible due to lignin. Other peels like mango and pomegranate are excellent sources of functional polyphenols, and citrus peels yield both oils and hydrocolloids.

15. (D) It deactivates pectin esterase to prevent pectin degradation.
Blanching citrus peels prior to pectin extraction utilizes heat treatment to deactivate endogenous enzymes, particularly pectin methylesterase. If these enzymes remain active, they rapidly hydrolyze the ester groups on the pectin chain, leading to uncontrolled de-esterification and chain cleavage. This enzyme inactivation ensures the recovery of high-quality pectin with superior gelling properties.

16. (C) Lycopene
Tomato processing by-products, consisting of skins and seeds, are rich reservoirs of lycopene. Lycopene is a highly lipophilic, acyclic carotenoid pigment responsible for the deep red color of tomatoes. It is recovered for use as a natural food colorant and as a functional ingredient due to its exceptional singlet oxygen quenching and antioxidant capabilities.

17. (A) 1 and 3
Supercritical fluid extraction using carbon dioxide is highly effective for recovering non-polar bioactive lipophilic compounds without leaving hazardous organic solvent residues. Similarly, polar polyphenols are conventionally extracted using polar solvents like aqueous ethanol. Conversely, ultrasound-assisted extraction enhances mass transfer at lower temperatures, while carotenoids are highly hydrophobic and insoluble in cold aqueous buffers.

18. (D) They are used as natural antioxidants to inhibit lipid oxidation in foods.
Polyphenols recovered from fruit processing wastes exhibit potent free radical scavenging activity and metal chelating properties. In food formulations, they are applied as natural antioxidants to inhibit lipid oxidation, preserve sensory quality, and extend shelf life, serving as effective clean-label alternatives to synthetic antioxidants like butylated hydroxytoluene and butylated hydroxyanisole.

Click Here to Buy book on Amazon

ANSWERS

1. (B) A secondary product obtained from a manufacturing process or chemical reaction
By-products represent secondary materials generated incidentally during the primary manufacturing process of a food item. In food processing, these substances possess potential economic value and can be successfully upcycled or converted into functional ingredients, biofuels, or animal feed, distinguishing them from valueless waste or hazardous materials requiring specialized toxic disposal protocols.

2. (B) 1, 3, and 4
By-product utilization in the food industry reduces environmental pollution by lowering biological oxygen demand in waste streams. It also provides functional ingredients and bioactive compounds while supporting circular economy models. By converting waste into value-added products, manufacturers can generate additional revenue streams and significantly lower overall disposal costs rather than increasing production expenses.

3. (A) It contains lactose, proteins, minerals, and water-soluble vitamins.
Whey is the liquid co-product remaining after milk coagulation during cheese or casein manufacturing. It consists of valuable components, primarily lactose, soluble proteins such as beta-lactoglobulin and alpha-lactalbumin, essential minerals, and water-soluble B-vitamins. Casein and milk fat are largely retained in the curd, making whey a nutrient-rich, low-fat source for functional food applications.

4. (C) The liquid permeate containing mostly lactose, minerals, and water
Whey permeate is the liquid stream generated when whey undergoes ultrafiltration to separate protein molecules from lower-molecular-weight components. The membrane retains the larger proteins as retentate, while allowing water, lactose, minerals, and soluble vitamins to pass through as permeate. This byproduct is commonly dried and used as a carbohydrate source in diverse food products.

5. (A) Both A and R are true and R is the correct explanation of A.
Whey proteins possess an exceptionally high biological value because they contain all essential amino acids in highly digestible forms. Their rapid absorption rate and high concentration of branched-chain amino acids, specifically leucine, isoleucine, and valine, stimulate muscle protein synthesis. This unique nutritional profile makes them highly effective and widely utilized ingredients in sports nutrition products.

6. (D) Ultrafiltration
Ultrafiltration is a pressure-driven membrane separation process that utilizes a semipermeable membrane with specific pore sizes to separate molecules based on molecular weight. It efficiently retains large protein fractions like whey proteins in the retentate while permitting smaller molecules, including lactose, minerals, and water, to pass through into the permeate, achieving precise fractionation.

NODIA

7. (B) Grape seeds – Glucosinolates
Grape seeds are exceptionally rich in proanthocyanidins and oligomeric catechins, which are potent antioxidants, rather than glucosinolates. Glucosinolates are sulfur-containing compounds characteristically found in cruciferous vegetables like mustard, rapeseed, broccoli, and cabbage. Apple pomace is a standard source of pectin, tomato pomace provides lycopene, and citrus peels yield valuable essential oils and flavonoids.

8. (A) P-II, Q-I, R-III, S-IV
Whey derivatives are customized for specific applications based on composition. Whey protein isolates contain over ninety percent protein, while concentrates vary from thirty-five to eighty percent. Demineralized whey is treated to reduce ash content, making it ideal for infant formulas. Lactose acts as a versatile fermentation substrate, particularly for industrial bioethanol production.

9. (D) κ-Casein
Kappa-casein is a major structural phosphoprotein of milk that belongs to the casein family, which precipitates during curd formation in cheesemaking. In contrast, beta-lactoglobulin,

evaluates the antioxidant capacity of polyphenol-rich extracts by measuring the reduction of the purple DPPH radical to a yellow compound. Other methods, such as Kjeldahl or Soxhlet, measure proteins and lipids, respectively.

29. (A) Stabilization permanently fortifies the bran with synthetic antioxidants.
Rice bran stabilization is a physical or thermal preservation process, not a chemical fortification with synthetic antioxidants. Its primary objective is to deactivate endogenous lipase enzymes that rapidly hydrolyze lipids into free fatty acids immediately after milling. This inactivation is typically achieved using dry or moist heat, such as extrusion cooking or infrared heating.

30. (C) Cause: Milling cellular disruption; Effect: Lipase-oil interaction yielding free fatty acids.
The high susceptibility of raw rice bran to rancidity is caused by the disruption of cellular structures during the milling process. This mechanical disruption brings endogenous lipase enzymes into direct contact with lipids. The resulting rapid enzymatic hydrolysis yields free fatty acids, which are highly vulnerable to subsequent auto-oxidation, leading to off-flavors and odors.

31. (D) γ-Oryzanol
Gamma-oryzanol is a unique mixture of ferulic acid esters of sterols and triterpene alcohols present in rice bran oil. It is highly valued for its health-promoting properties, particularly its ability to lower blood cholesterol levels by inhibiting absorption in the gut. This bioactive compound also exhibits exceptional antioxidant stability under thermal processing conditions.

32. (B) 1, 2, and 4
Rice bran oil is extracted using hexane and refined through dewaxing to ensure clarity at low temperatures. High initial free fatty acids lead to severe oil loss during chemical neutralization due to soap formation. Physical refining is highly suitable and preferred for high-acid rice bran oil because it removes free fatty acids by steam distillation.

33. (B) Physical refining uses steam distillation to remove free fatty acids, reducing oil loss.
Physical refining is highly advantageous for oils with high free fatty acid content, such as rice bran oil. It utilizes high-temperature steam distillation under vacuum to directly volatilize and remove free fatty acids. This eliminates the chemical neutralization step using sodium hydroxide, thereby preventing the formation of soapstock and significantly reducing neutral oil losses.

34. (D) The outermost layer of the endosperm, removed with the bran, rich in proteins and lipids.
The aleurone layer constitutes the outermost cell layer of the endosperm in cereal grains and is typically removed along with the maternal pericarp during milling as part of the bran. It is biochemically distinct from the starchy endosperm, containing high concentrations of proteins, lipids, essential minerals, dietary fiber, and B-complex vitamins.

35. (C) A is true but R is false.
Defatted soy meal is widely used to manufacture textured vegetable protein and meat analogs due to its exceptionally high protein content. When subjected to high-moisture extrusion cooking, these proteins align and cross-link to form a fibrous, chewy structure resembling animal muscle tissue. The claim that it has low protein content is entirely false.

36. (C) Mechanical prepressing followed by solvent extraction of the press cake
For high-oil seeds like sunflower, the most competent industrial processing sequence combines mechanical pre-pressing with solvent extraction. Pre-pressing mechanically removes the bulk of the oil, reducing the solvent load and energy requirements. The resulting press cake is then extracted with hexane to recover residual oil, yielding a high-quality, protein-rich defatted meal.

37. (A) Groundnut meal – Glucosinolates
Groundnut meal is not associated with glucosinolates; its primary safety concern is contamination by aflatoxins produced by Aspergillus fungi. Glucosinolates are characteristic anti-nutritional factors of rapeseed and mustard meals. Other meals are correctly matched with their respective anti-nutritional factors, including trypsin inhibitors in soybean meal and toxic polyphenolic gossypol in cottonseed meal.

38. (A) P-III, Q-I, R-IV, S-II
Each refining step in rice bran oil processing targets specific impurities. Degumming removes hydrating and non-hydrating phosphatides. Neutralization utilizes alkaline agents to eliminate

Downloaded from www.pdf.tube

free fatty acids as soapstock. Bleaching employs activated clays to absorb undesirable pigments and oxidation products. Finally, deodorization applies steam distillation under vacuum to remove volatile odoriferous compounds and off-flavors.

39. (B) Extraction of high-value essential oils for perfumery
Defatted oilseed meals are protein-rich solid residues from which virtually all lipids have been removed. Consequently, they cannot be used to extract volatile essential oils, which are hydrophobic aroma compounds found in aromatic plants, not oilseeds. Instead, these meals are used to produce protein isolates, enrich baked goods, and prepare hydrolyzed vegetable proteins.

40. (C) Pomace – The solid remains of fruit after pressing
Pomace is defined as the solid residue remaining after pressing fruits or vegetables for juice or oil extraction, such as apple or tomato pomace. In contrast, germ refers to the nutrient-rich embryo of a grain, bran is the protective outer layer of cereal seeds, and permeate is the liquid stream that passes through a filtration membrane.

41. (A) Both Statement I and Statement II are correct.
Phytic acid is a well-known anti-nutritional factor concentrated in cereal brans that reduces mineral bioavailability by chelating divalent cations like iron and zinc. However, biological processes such as fermentation or yeast-leavening activate endogenous phytase enzymes. These enzymes hydrolyze phytate into lower inositol phosphates, successfully releasing the bound minerals and improving nutritional quality.

42. (A) Aflatoxin
Aflatoxins are highly toxic, carcinogenic, and mutagenic mycotoxins primarily produced by the molds Aspergillus flavus and Aspergillus parasiticus. Groundnuts are highly susceptible to these fungi under warm, humid storage conditions. Contaminated groundnut meal must be rejected because aflatoxins are extremely heat-stable and persist through standard food processing operations.

43. (A) 2, 1, 5, 3, 4
The industrial extraction of oilseeds begins with cleaning and dehulling to remove extraneous material. The seeds are then flaked and conditioned using heat to disrupt oil cells. Next, mechanical pre-pressing extracts the majority of the oil. The remaining press cake undergoes solvent extraction with hexane, and the defatted meal is finally desolventized.

44. (B) Mechanically separated meat (MSM) is strictly banned from use in any processed meat products like hot dogs or sausages.
Mechanically separated meat is not banned from processed meats; it is widely utilized as a cost-effective, functional ingredient in products like hot dogs, nuggets, and sausages, subject to strict labeling and calcium level regulations. Other statements are correct: rendering stabilizes wastes, blood plasma acts as a binder, and poultry feathers yield hydrolyzed meal.

45. (A) Cause: Heating; Effect: Trypsin inhibitor denaturation, improving protein digestibility.
The application of thermal energy during the desolventizing-toasting phase of soy processing is critical. The high temperature and moisture cause the denaturation of heat-labile anti-nutritional factors, specifically Kunitz and Bowman-Birk trypsin inhibitors. Denaturing these inhibitors prevents them from binding pancreatic enzymes, thereby significantly improving the overall protein digestibility of the soy meal.

46. (C) Collagen from animal bones and hides
Gelatin is a high-molecular-weight hydrocolloid produced by the partial, irreversible thermal denaturation and hydrolysis of collagen. Collagen is the principal structural protein found abundantly in animal connective tissues, particularly bones, hides, skins, and tendons. Keratin, elastin, and myosin represent distinct structural or contractile proteins that do not yield gelatin upon hydrolysis.

47. (B) 1, 3, and 4
Collagen peptides are produced by the enzymatic hydrolysis of collagen or gelatin, breaking them into low-molecular-weight chains. Because of their small size, they are highly soluble in cold water and completely lose the ability to form thermoreversible gels. They are widely used in functional beverages and supplements for skin and joint health.

NODIA

48. (C) Type A uses acid pretreatment of collagen, while Type B uses alkaline pretreatment.
The primary distinction between Type A and Type B gelatin lies in the chemical pretreatment

applied to the precursor collagen. Type A gelatin is produced using acid pretreatment, which is typically applied to porcine skins. Type B gelatin is produced using alkaline pretreatment, which is applied to bovine hides and bones to disrupt more complex cross-links.

49. (B) The edible internal organs and entrails of an animal
Offal refers to the edible internal organs and entrails of butchered animals, excluding skeletal muscle. This includes organs such as the liver, heart, kidneys, tripe, and brain. Offal represents a highly nutritious meat processing co-product rich in high-quality proteins, vitamins, and minerals, though its consumption varies widely across different culinary cultures.

50. (A) Both A and R are true and R is the correct explanation of A.
Blood plasma recovered from slaughterhouses is highly valued as a functional food additive in emulsified meat systems. Plasma contains albumin and globulin proteins that exhibit exceptional heat-induced gelation, water-binding, and fat-emulsifying properties. These features allow plasma to effectively stabilize fat-and-water emulsions and strengthen the structural matrix of processed meat formulations.

51. (A) Collagen peptides are fully soluble in cold liquids and do not increase viscosity.
In clear sports beverages, collagen peptides are preferred over intact gelatin because their low molecular weight renders them highly soluble in cold liquids without increasing viscosity or forming a gel at refrigeration temperatures. Intact gelatin would increase viscosity and form a cohesive gel, making the beverage unpalatable and physically unstable when cooled.

52. (C) Poultry feathers – Extraction of functional whey proteins
Poultry feathers are composed of keratin, which is a structural protein, and are processed into hydrolyzed feather meal. They do not contain whey proteins, which are exclusively derived from milk during dairy processing. Other pairs are correct: hides yield gelatin, bones provide calcium supplements, and intestines are used for sausage casings.

53. (A) P-II, Q-III, R-IV, S-I
Animal by-products have distinct commercial applications. Fish swim bladders yield isinglass, which is used for clarifying alcoholic beverages. Porcine skin is acid-pretreated to produce Type A gelatin. Bovine bones are alkaline-treated for Type B gelatin and yield bone ash. Poultry feathers are chemically or enzymatically hydrolyzed to produce digestible keratin feed.

54. (D) Primary leavening agent in baked goods
Gelatin functions as a gelling agent, thickener, stabilizer, and clarifying agent in the food industry. However, it cannot act as a leavening agent in baked goods. Leavening requires the production of gas, which is achieved through biological agents like yeast or chemical agents like baking powder, neither of which involves gelatin.

55. (B) Fish silage – Liquefied waste produced by endogenous enzymes and acid
Fish silage is a liquefied product made from whole fish or fish parts that are preservation-stabilized by adding acid. This acidic environment activates endogenous proteolytic enzymes, which break down and liquefy the tissues into a stable protein hydrolysate. Conversely, fish maw is used for isinglass, and scales provide collagen, not omega-3 fatty acids.

56. (A) Both Statement I and Statement II are correct.
Fish meal is an industrial dry powder produced by cooking, pressing, drying, and grinding whole fish or processing wastes like heads and frames. This process removes water and oil, leaving a highly concentrated protein residue. Fish meal is globally recognized as a premier, highly digestible protein source in diets for aquaculture and poultry.

57. (D) Addition of antioxidants like tocopherols or BHT and storage under inert gas
Fish oil contains high levels of long-chain polyunsaturated fatty acids, which are highly susceptible to free radical-mediated autoxidation. To prevent rapid rancidity and preserve nutritional quality, the immediate addition of lipophilic antioxidants like tocopherols or butylated hydroxytoluene is critical. Additionally, storing the oil under an inert gas like nitrogen prevents contact with atmospheric oxygen.

Click Here to Buy book on Amazon

58. (A) Fish gelatin has lower gelling and melting points due to low hydroxyproline.
Fish gelatin contains significantly lower concentrations of the imino acids proline and hydroxyproline compared to mammalian gelatin. These imino acids are essential for stabilizing the triple-helix structure of collagen. Consequently, fish gelatin exhibits much lower gelling and melting temperatures, requiring specialized handling in food formulations that require thermal stability at room temperature.

59. (B) They are rich in tryptophan, making them a complete dietary protein source.
Collagen and its derived peptides are nutritionally incomplete proteins because they completely lack the essential amino acid tryptophan. Although they possess very high concentrations of glycine, proline, and hydroxyproline, they cannot serve as a sole dietary protein source. They are low-molecular-weight molecules that do not form gels, making them highly water-soluble.

60. (B) Cause: Formic acid lowers pH; Effect: Prevents spoilage while letting enzymes liquefy the tissue.
Adding formic acid to fish waste lowers the pH to approximately four. This acidic environment effectively inhibits the growth of spoilage bacteria and pathogens, preserving the material. Simultaneously, it maintains the activity of endogenous proteolytic enzymes, allowing them to hydrolyze and liquefy the fish proteins into a stable, nutrient-rich liquid silage.

61. (A) Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA)
Eicosapentaenoic acid and docosahexaenoic acid are the two principal long-chain omega-3 polyunsaturated fatty acids derived from marine by-products. These fatty acids contain five and six double bonds, respectively, and are highly valued for their clinical cardiovascular and cognitive health benefits. They are biochemically distinct from plant-derived alpha-linolenic acid and other saturated fats.

62. (A) 1, 2, and 4
Concentrating omega-3 fatty acids from fish oil is achieved through several advanced techniques. Urea complexation precipitates saturated and monounsaturated fatty acids, leaving polyunsaturated fractions. Short-path molecular distillation separates components based on boiling points under high vacuum. Enzymatic methods utilize selective lipases, whereas supercritical extraction is actually highly effective for separating these valuable lipids.

63. (D) An integrated facility converting biomass into biofuels, biochemicals, and food ingredients.
A biorefinery is an integrated processing facility that sustainably processes biomass into a wide spectrum of marketable products. This includes converting food processing wastes and agricultural residues into biofuels, bioenergy, industrial biochemicals, and functional food ingredients. It maximizes value extraction while minimizing waste, serving as a core component of the circular bioeconomy.

64. (C) Ethanol produced by anaerobic yeast fermentation of carbohydrate-rich wastes
Bioethanol is an ethyl alcohol produced through the biochemical conversion of carbohydrate-rich food processing wastes, agricultural residues, or starch-containing industrial by-products. This process involves the enzymatic hydrolysis of complex carbohydrates into fermentable simple sugars, followed by anaerobic fermentation by yeasts like Saccharomyces cerevisiae and subsequent purification through distillation.

65. (A) Both A and R are true and R is the correct explanation of A.
Lignocellulosic by-products possess a highly complex, recalcitrant structure composed of cellulose, hemicellulose, and lignin. This matrix physically shields cellulose from enzymatic attack. Implementing physical or chemical pretreatment is essential to disrupt this protective network and remove lignin, thereby making the cellulose polymers accessible to cellulase enzymes for efficient saccharification into fermentable sugars.

66. (D) Enzymatic saccharification followed by yeast fermentation
To maximize bioethanol yield from apple pomace, starch and structural polysaccharides must first be broken down. This is achieved through enzymatic saccharification, which uses cellulases and amylases to hydrolyze complex polymers into simple fermentable sugars. Subsequently, yeasts like Saccharomyces cerevisiae ferment these sugars anaerobically to produce ethanol, which is then recovered by distillation.

NODIA

67. (A) Fourth-generation biofuels – Produced directly from rendering plant animal fats via transesterification
Fourth-generation biofuels utilize genetically engineered microorganisms or algae to directly capture carbon dioxide and produce solar fuels, rather than animal fats. Converting rendered animal fats via transesterification yields biodiesel, which is classified as a first-generation or second-generation fuel. Other classifications are correct, including algae-derived third-generation and crop-derived first-generation biofuels.

68. (A) P-II, Q-I, R-IV, S-III
Different food waste streams are suited for specific valorisation pathways. Used cooking oil is converted to biodiesel via transesterification. Potato peel waste, rich in starch, is hydrolyzed and fermented into bioethanol. Crustacean shells are chemically treated to extract chitin and chitosan. Dairy effluent is processed in anaerobic digesters to generate biogas.

69. (A) Lactic acid
Harsh acid pretreatment of lignocellulosic biomass degrades sugars and lignin into inhibitory compounds like furfural, hydroxymethylfurfural, and acetic acid, which can inhibit subsequent yeast fermentation. Lactic acid, however, is a product of bacterial fermentation and is not formed as a chemical degradation product during the thermochemical acid hydrolysis of lignocellulose.

70. (D) Hydrolysis stage – Extracellular breakdown of complex organics into simple monomers
The first step in anaerobic digestion is the hydrolysis stage, where hydrolytic bacteria secrete extracellular enzymes to break down complex polymers like proteins, carbohydrates, and lipids into soluble monomers. These monomers are subsequently converted during acidogenesis and acetogenesis, ultimately serving as substrates for methanogenic archaea to produce biogas in the final stage.

71. (A) Both Statement I and Statement II are correct.
Biogas produced from the anaerobic digestion of food effluents is primarily composed of methane and carbon dioxide. The methanogenic archaea responsible for the final conversion of acetate and hydrogen into methane are strict obligate anaerobes. They lack enzymes to detoxify oxygen, meaning even trace oxygen exposure can disrupt their metabolism and halt biogas production.

72. (C) Ammonia toxicity from protein degradation, inhibiting methanogens
Anaerobic digestion of high-protein waste releases significant amounts of ammonium ions and free ammonia during deamination. High free ammonia concentrations are highly toxic to methanogenic archaea, which are the most sensitive organisms in the system. This toxicity inhibits their metabolic activity, resulting in a sudden drop in methane yield and an alkaline pH rise.

73. (A) 2, 4, 3, 1
Anaerobic digestion proceeds through four sequential biological stages. First, hydrolysis breaks down complex organic polymers into soluble monomers. Second, acidogenesis converts these monomers into volatile fatty acids and organic acids. Third, acetogenesis transforms these acids into acetic acid, carbon dioxide, and hydrogen. Finally, methanogenesis utilizes these substrates to produce methane gas.

74. (A) Chitosan is the completely acetylated, water-insolidation derivative of chitin.
Chitosan is the deacetylated derivative of chitin, not a completely acetylated compound. It is solubilized in dilute organic acids due to protonation of its free amino groups, whereas chitin is highly acetylated and completely insoluble in water. Chitin forms the structural shell of crustaceans, and its extraction involves acid demineralization and alkaline deproteinization.

75. (B) Treatment with hot alkali; Effect: Polymer deacetylation, enabling solubility in dilute acids.
The conversion of chitin to chitosan requires treating chitin with hot, concentrated alkaline solutions, typically sodium hydroxide. This chemical treatment hydrolyzes the acetamide groups, removing acetyl groups to yield free amine groups. This deacetylation process increases the polymer's charge density, enabling it to dissolve readily in dilute acidic aqueous solutions.

76. (B) Brewer's Spent Grain (BSG)
Brewer's spent grain is the most abundant solid by-product generated during the mashing stage of the brewing process, accounting for approximately eighty-five percent of the total waste. It consists of the insoluble outer layers of barley grain malt, including the husk and pericarp, which remain

NODIA

after the soluble starches have been extracted into the wort.

77. (B) 1, 3, and 4
Brewer's spent grain is rich in protein and dietary fiber, making it highly valuable for animal feed and upcycled bakery flours. However, it emerges from the mashing process with an extremely high moisture content of seventy to eighty percent. This high moisture makes it highly unstable and prone to rapid microbial spoilage if not dried immediately.

78. (C) SCG can be processed to extract coffee oil for use in cosmetics and biodiesel.
Spent coffee grounds are rich in lipids, which can be extracted to yield high-value coffee oil. This oil is extensively used in cosmetic formulations due to its antioxidant properties and can also serve as a feedstock for biodiesel production. Conversely, spent grounds are highly compostable and are not composed of soluble simple sugars or proteins.

79. (D) The controlled aerobic biological decomposition of organic matter into stable humus.
Composting is a natural waste management process defined as the controlled, aerobic biological decomposition of organic materials. During this process, mesophilic and thermophilic microorganisms break down complex organic matter in the presence of oxygen and moisture, generating heat and water vapor. The final stabilized product is rich in nutrients and forms high-quality organic humus.

80. (A) Both A and R are true and R is the correct explanation of A.
Wet brewer's spent grain must be processed or dried within forty-eight hours of production to prevent spoilage. It contains seventy to eighty percent water and is highly nutritious, offering an ideal environment for rapid bacterial and mold growth. Immediate stabilization is essential to preserve its quality and prevent the production of off-flavors or hazardous toxins.

81. (B) Caffeine
Tea fluff is a major fiber-rich by-product generated during the grading and packaging of dry tea leaves. Before being composted, it is primarily targeted for the commercial extraction of caffeine. Caffeine is highly valued as a functional additive in the beverage and pharmaceutical industries, and its recovery from tea fluff provides a profitable upcycling pathway.

82. (D) Spent tea leaves – A highly concentrated source of pure starch used for edible films
Spent tea leaves do not contain significant amounts of starch; instead, they are composed of cellulose, lignin, and residual polyphenols. Other pairs are correct: coffee cascara represents dried cherry skins, tea fluff is fiber and stem waste, and coffee silverskin is the thin outer layer of the bean that is removed during the roasting process.

83. (A) P-III, Q-I, R-IV, S-II
The extraction of chitosan from crustacean shells requires several sequential chemical steps. Deproteinization uses dilute sodium hydroxide to remove proteins. Demineralization utilizes dilute hydrochloric acid to dissolve calcium carbonate. Decoloration uses hydrogen peroxide or acetone to remove pigments. Finally, deacetylation employs concentrated sodium hydroxide under high heat to convert chitin into soluble chitosan.

84. (C) The extremely low biological oxygen demand (BOD) of food wastes
Food processing wastes typically exhibit extremely high biological oxygen demand, which makes their untreated discharge environmentally hazardous and subject to severe regulatory penalties. Therefore, low BOD is not a barrier to valorisation. True economic barriers include high moisture content, which increases drying and transport costs, seasonal availability of materials, and complex regulatory approval pathways.

85. (A) GRAS – Generally Recognized As Safe (a regulatory designation for ingredients)
The GRAS designation is a widely recognized regulatory pathway indicating that a substance is generally considered safe by qualified experts under its intended conditions of use. Conversely, novel foods lack a history of consumption, upcycled ingredients are destined for human consumption rather than chemical conversion, and regulations support rather than ban the safe use of agricultural by-products.

86. (C) Statement I is correct but Statement II is incorrect.
Incorporating upcycled ingredients like defatted seed meals requires rigorous toxicological assessments to ensure that any anti-nutritional factors present are below safe limits. However,

Downloaded from www.pdf.tube

the circular economy model directly opposes the traditional linear "take-make-dispose" framework, instead advocating for continuous resource loop systems that minimize waste generation and maximize the reuse of materials.

87. (B) Approval under the FSSAI Non-Specified Food and Food Ingredients Regulations
Under FSSAI regulations in India, any food ingredient or additive that does not have a defined standard or a history of safe consumption must obtain clearance through the approval process for non-specified food and food ingredients. This pathway requires submitting comprehensive safety, toxicological, and manufacturing data to prove that the novel extract is completely safe.

88. (C) Extracting pectin from citrus peels for use in commercial jams
Valorisation refers to the process of converting waste materials or by-products into higher-value products. Extracting high-purity pectin from citrus peels for use in commercial food applications perfectly illustrates this concept within a circular economy framework. Practices like landfilling, direct incineration of wet streams, or simple effluent dilution represent linear disposal methods that fail to recover value.

89. (D) Valorisation guarantees a lower footprint regardless of energy intensity.
Life cycle assessments systematically evaluate the environmental impacts of a process from raw material extraction to final disposal. While by-product valorisation is generally beneficial, it does not guarantee a lower environmental footprint. If the extraction, purification, and drying processes require excessive energy or hazardous chemicals, the overall environmental impact can exceed that of conventional disposal.

90. (A) Cause: Minimizing waste and recovering value; Effect: Enhanced resource efficiency.
Applying circular economy principles directly aims to minimize waste generation and maximize the recovery of valuable components from by-products. This practice enhances overall resource efficiency by keeping materials in productive economic loops for as long as possible, reducing the demand for virgin resources and minimizing the environmental impacts associated with conventional waste disposal.

91. (B) Gelling and thickening agent
Pectin is a complex structural polysaccharide found in the cell walls of terrestrial plants, particularly citrus fruits and apples. In the food industry, its primary functional application is serving as a hydrocolloid gelling and thickening agent. It is widely used to define the texture and viscosity of jams, jellies, marmalades, and fruit preparations.

92. (A) 1, 2, and 3
Astaxanthin is a highly valued, vibrant pink-red xanthophyll carotenoid pigment commonly recovered from crustacean shell waste. It possesses exceptional antioxidant activity, exceeding that of beta-carotene. Because it is a carotenoid, it is highly lipophilic and soluble in lipids, while remaining poorly soluble in water, making water-based extraction methods highly ineffective for its recovery.

NODIA

93. (A) Tea seed oil, rich in unsaturated fatty acids, is used as edible oil.
Tea seed oil is a major by-product of tea seed processing that is rich in unsaturated fatty acids, particularly oleic acid, making it highly suitable as a premium edible oil. Conversely, spent tea leaves are rich in cellulose and lignins, not gluten, and they retain significant amounts of polyphenols even after primary brewing operations.

94. (C) Creating high-value products from food by-products that would otherwise be wasted.
Upcycling in the food industry is defined as the process of transforming surplus food or processing by-products that would otherwise go to waste into new, high-value ingredients or products fit for human consumption. This practice differs from downcycling, which converts waste into lower-value materials like animal feed, compost, or bioenergy.

95. (A) Both A and R are true and R is the correct explanation of A.
Enzyme-assisted extraction is highly effective for recovering bioactive compounds from plant by-products. Plant cell walls consist of complex structural networks of cellulose, hemicellulose, and pectin. Utilizing specific enzymes like cellulases and pectinases hydrolyzes these barriers, increasing cell wall permeability. This disruption enhances mass transfer, facilitating the rapid release of bound intracellular phytochemicals into the solvent.

Visit :
www.pdf.tube

Download PDFs For :

- ✓ MPPSC Chapterwise Question Bank
- ✓ KVS/NVS Chapterwise Question Bank
- ✓ KVS/NVS 30 Sample Papers for Tier-II
- ✓ DSSSB TGT Chapterwise Question Bank
- ✓ DSSSB Sample Papers
- ✓ Chapterwise Question Bank
- ✓ JEE NEET Foundation
- ✓ Primary Classes Worksheets
- ✓ Olympiad Guide
- ✓ Sample Papers
- ✓ Previous Year CBSE Papers
- ✓ Previous JEE, NEET and CUET Papers

Nodia Editions LLP

125, Sector 6, Vidhyadhar Nagar, Jaipur 302039

MRP ₹ 750.00

Click Here to Buy book on Amazon

to a rapid accumulation of VFAs, causing the pH to drop below the neutral range. This low pH severely inhibits methanogens, halting methane production and souring the entire digester system.

106. (A) Degree of esterification (DE)
The primary structural distinction between high methoxyl and low methoxyl pectin is the degree of esterification, which represents the percentage of galacturonic acid residues esterified with methyl groups. High methoxyl pectin has a DE greater than fifty percent, while low methoxyl pectin has a DE less than fifty percent, which dictates their respective gelling mechanisms.

107. (C) 1, 2, 3, and 4
Bloom strength measures the firmness and structural integrity of a gelatin gel under standardized conditions. Higher Bloom values indicate stronger gels with superior mechanical properties, which are highly preferred for manufacturing hard pharmaceutical capsules. Low Bloom gelatins form weaker networks and are selected for applications where viscosity modification is desired without establishing a rigid gel structure.

108. (B) Polycationic chitosan disrupts negatively charged cell membranes of spoilage microbes.
Chitosan acts as a highly effective natural food preservative due to its polycationic nature in acidic environments. The positively charged amino groups on the chitosan polymer chain interact electrostatically with the negatively charged components of microbial cell membranes. This interaction disrupts membrane integrity, leading to leakage of essential intracellular constituents and cell death.

109. (A) The high-protein residual meal left after solvent extraction of soybean oil.
Defatted soy meal is the solid, high-protein residue remaining after soybeans have been cracked, flaked, and subjected to chemical solvent extraction to remove the soybean oil. This meal contains approximately forty-eight to fifty percent protein on a dry basis, making it a highly valued raw material for animal feed, soy concentrates, and texturized proteins.

110. (A) Both A and R are true and R is the correct explanation of A.
Winterization is a thermomechanical fractionation step in refining marine oils. Fish oils contain high-melting-point saturated triglycerides, known as stearins, which crystallize and cause cloudiness at refrigeration temperatures. Chilling the oil under controlled conditions crystallizes these solid fats, which are then removed by filtration, ensuring the refined oil remains completely clear and liquid at low temperatures.

111. (D) Microencapsulating the oil using a hydrophilic wall material like modified starch
Developing clear, fortified water with fish oil is challenging due to the lipid's hydrophobic nature and susceptibility to oxidation and off-flavors. Microencapsulating the oil within a hydrophilic wall material, such as modified starch or gum arabic, protects the omega-3 fatty acids from oxygen. This technique enables stable dispersion in aqueous systems without releasing unpleasant marine flavors.

112. (C) Soybean hulls – High-value commercial pectin extraction
Soybean hulls are composed of cellulose, hemicellulose, and acidic polysaccharides, but they are not used commercially for pectin extraction. High-value commercial pectin is extracted almost exclusively from citrus peels and apple pomace. Other plant by-products are correctly paired with their uses, including cocoa pods for activated carbon and coconut coir as a growing medium.

NODIA

113. (A) P-II, Q-III, R-IV, S-I
Microorganisms are selected for waste valorisation based on their metabolic pathways. Saccharomyces cerevisiae ferments hexose sugars into bioethanol. Lactic acid bacteria produce lactic acid to lower pH and preserve fish silage. Aspergillus niger is used in solid-state fermentation of pomace to produce citric acid. Methanogenic archaea carry out anaerobic digestion to convert organic acids into biogas.

114. (D) Highly digestible by human pancreatic amylase
Dietary fiber from cereal bran consists of structural polysaccharides like cellulose, hemicellulose, and lignin, which are completely resistant to digestion by human pancreatic amylase. Fiber increases fecal bulk and water retention in doughs, and it can affect the sensory properties of baked goods. However, it passes largely intact into the large intestine for microbial fermentation.

96. (C) Using ultrafiltration to produce Whey Protein Concentrate (WPC)
To maximize economic return and produce a human-grade functional ingredient, a dairy plant should process cheese whey using ultrafiltration. This membrane technology concentrates the high-value whey proteins into whey protein concentrate. This approach provides a highly profitable, clean-label ingredient for the food industry, whereas direct land application or biogas generation yields significantly lower economic value.

97. (B) Potato peel waste – Extraction of gluten
Potato peels do not contain gluten; gluten is a structural protein complex found exclusively in cereal grains like wheat, barley, and rye. Potato peels are instead processed to extract starch, dietary fiber, and polyphenols. Other pairs are correct: olive wastewater yields hydroxytyrosol, onion peels provide quercetin, and citrus pulp is a source of dietary fiber.

98. (A) P-III, Q-I, R-II, S-IV
Enzymes are highly specific catalysts used in by-product valorisation. Cellulases break down plant cell walls to release bound polyphenols. Proteases hydrolyze proteins in fish waste to produce stable liquid silage. Phytases degrade phytic acid in cereal brans to improve mineral bioavailability. Pectinases degrade pectin to facilitate juice clarification and the extraction of citrus peel bioactives.

99. (A) It requires the use of highly toxic organic co-solvents to function.
Supercritical carbon dioxide extraction is highly advantageous because it is a green technology that does not require toxic organic solvents. Carbon dioxide is non-toxic, non-flammable, and easily removed by depressurization, leaving no chemical residue. It operates at low temperatures, making it ideal for extracting heat-sensitive functional lipids and preserving bioactive omega-3 fatty acids from oxidation.

100. (C) Liquefaction – α-amylase breakdown of gelatinized starch to dextrins
In the conversion of starch-rich by-products to bioethanol, liquefaction is defined as the thermal-enzymatic hydrolysis of gelatinized starch into shorter-chain soluble dextrins, typically catalyzed by thermostable alpha-amylases. Saccharification is the subsequent step where glucoamylase hydrolyzes dextrins into glucose, which is then fermented by yeast, while distillation concentrates the final bioethanol product.

101. (C) Statement I is correct but Statement II is incorrect.
Distillers Dried Grains with Solubles is a major co-product of the bioethanol industry, produced by drying the residual yeast and grain fermentation slurry. However, DDGS is highly rich in protein, lipids, and minerals, making it an extremely valuable, nutrient-dense animal feed ingredient rather than a low-grade fuel intended for waste incineration.

102. (D) Iso-alpha-acids from hops
The bitterness in brewery trub is primarily caused by iso-alpha-acids derived from hops added during the boiling stage of brewing. These compounds are highly hydrophobic and readily adsorb onto precipitating proteins and yeast cell walls during fermentation. Consequently, they concentrate in the trub, requiring specialized debittering treatments, such as alkaline washing, before use in food.

103. (A) 2, 4, 1, 5, 3
Protein extraction from defatted oilseed meal begins with alkaline extraction to solubilize the proteins at high pH. The mixture is centrifuged to separate the insoluble fiber from the liquid extract. The pH is then adjusted to the isoelectric point to precipitate the proteins, which are collected via centrifugation and subsequently spray-dried into a stable isolate.

104. (C) It relies entirely on increasing landfill capacity for biodegradable waste.
The circular economy in food processing directly aims to eliminate the landfilling of organic waste by keeping materials within productive loops. Relying on increasing landfill capacity is a characteristic of linear waste disposal systems. Circular strategies instead focus on recovering value through processes such as upcycling, anaerobic digestion, composting, and nutrient recycling.

105. (D) Cause: VFA production exceeds consumption; Effect: pH drop inhibits methanogens, stopping methane.
Over-acidification occurs when fast-growing acidogenic bacteria produce volatile fatty acids more rapidly than slow-growing methanogenic archaea can consume them. This imbalance leads

Downloaded from www.pdf.tube

124. (B) The liquid byproduct from pressing cooked fish, containing soluble proteins and residual oil.
Stickwater is the aqueous liquid by-product generated when cooked fish or fish processing wastes are mechanically pressed during fish meal and fish oil manufacturing. This liquid contains high concentrations of water-soluble proteins, minerals, and suspended oil droplets. It is typically concentrated by evaporation and added back to fish meal to enhance its overall nutritional value.

125. (A) Both A and R are true and R is the correct explanation of A.
Incorporating wheat bran into refined flour formulations significantly lowers the glycemic index of the final food product. This occurs because the abundant dietary fiber in the bran increases digesta viscosity, which slows gastric emptying and physical transport. This delay slows the rate of enzymatic starch digestion and glucose absorption in the small intestine, preventing blood sugar spikes.

126. (C) Microfiltration (to defat) followed by ultrafiltration and low-temperature spray drying
To produce undenatured whey protein isolate while preserving its native functional properties, a non-thermal membrane-based sequence is required. Microfiltration is first applied to remove residual fat globules and suspended solids. Ultrafiltration then concentrates and purifies the proteins by removing lactose and minerals. Finally, low-temperature spray drying preserves the molecular structure, preventing denaturation and loss of functionality.

127. (D) Pectin (Apple pomace) – Direct increase in postprandial glucose spikes
Pectin is a soluble dietary fiber that forms a viscous gel in the gastrointestinal tract, which actually slows gastric emptying and delays carbohydrate absorption. Consequently, consuming pectin reduces postprandial glucose spikes rather than increasing them. Other matches are correct, including anthocyanins as antioxidants, gamma-oryzanol as a cholesterol reducer, and EPA/DHA as anti-inflammatory agents.

128. (A) P-IV, Q-III, R-II, S-I
Specific valuable components are recovered from food waste streams based on composition. Whey permeate is processed to recover lactose and riboflavin. Apple pomace is a standard source of pectin and malic acid. Shrimp shells yield chitin, chitosan, and the carotenoid pigment astaxanthin. Soy molasses, a by-product of soy concentrate production, contains isoflavones and prebiotic oligosaccharides.

129. (B) It acts as a primary source of long-chain Omega-3 fatty acids.
Defatted groundnut meal is a terrestrial plant byproduct that contains virtually no marine-derived long-chain omega-3 fatty acids like EPA and DHA. However, it is highly valued for significantly increasing protein content, providing a cost-effective plant protein alternative, and improving water and oil binding capacities in processed meat formulations due to its excellent functional properties.

130. (D) Pig skin – Acid pretreatment (Type A) due to less collagen cross-linking
Gelatin extraction from pig skin typically utilizes acid pretreatment to produce Type A gelatin. This approach is highly efficient because porcine collagen has less complex covalent cross-linking compared to older bovine tissues. Consequently, it requires only a short acid wash to swell the tissue and facilitate subsequent thermal extraction, avoiding the intensive alkaline treatments needed for bovine hides.

131. (A) Both Statement I and Statement II are correct.
Refining crude rice bran oil removes undesirable components such as free fatty acids, unsaponifiable matter, waxes, and odoriferous compounds to ensure quality and shelf stability. Dewaxing is a critical step achieved by slowly chilling the oil under controlled conditions. This cooling crystallizes the high-melting-point waxes, which are subsequently separated via filtration or centrifugal operations.

132. (C) Add vital wheat gluten and ascorbic acid to strengthen the gluten network.
Brewer's spent grain is rich in fiber and lacks gluten-forming proteins, which dilutes the gluten network of dough and results in dense bread with poor volume. Adding vital wheat gluten restores the protein-to-starch balance, while ascorbic acid acts as an oxidizing agent to strengthen disulfide bonds, restoring dough gas retention and improving bread volume.

NODIA

133. (A) 3, 5, 2, 1, 4
The extraction of collagen peptides from animal hides begins with washing and mincing the raw material. The minced hide then undergoes acid or alkaline chemical pretreatment to swell the collagen fibers. Gelatin is extracted using hot water, followed by enzymatic hydrolysis to cleave the gelatin into low-molecular-weight peptides, which are finally filtered and spray-dried.

134. (D) Transportation costs are negligible because food wastes have an extremely high bulk density and low moisture.
Food wastes generally possess very low bulk densities and extremely high moisture contents, often exceeding seventy percent. This makes transporting raw by-products highly expensive and economically inefficient, as it involves hauling large volumes of water. Consequently, transportation costs represent a major economic barrier to valorisation, contrary to the claim that they are negligible.

135. (B) Cause: Wastewater recycling; Effect: Elimination of liquid effluent discharge to the environment.
Implementing a Zero Liquid Discharge system in a food processing plant involves treating and recycling all wastewater generated during processing. By using technologies such as membrane filtration, evaporation, and crystallization, the plant purifies and reuses the water. This process eliminates the discharge of liquid effluents into the environment, reducing pollution and conserving water.

136. (C) Transition from a linear model to continuously loop resources back into the value chain.
The core principle of the circular economy in the food industry is transitioning from a traditional linear "take-make-dispose" model to a closed-loop system. This framework aims to design out waste and pollution, keep products and materials in high-value use for as long as possible, and regenerate natural systems by turning by-products into new resources.

137. (A) 1, 2, and 4
FSSAI regulations require that any newly extracted compound without a history of consumption be approved as a novel food, supported by safety, toxicity, and allergenicity data. Additionally, residue limits for extraction solvents are strictly regulated. However, approval by the US FDA does not grant automatic exemption; independent regulatory approval must be obtained in India.

138. (A) FPH is enzymatically broken down into soluble peptides, whereas fish meal contains intact protein.
Fish protein hydrolysate is produced by treating fish wastes with proteolytic enzymes, which cleaves intact proteins into low-molecular-weight, highly water-soluble peptides. In contrast, conventional fish meal is produced by cooking, pressing, and drying fish, which denatures but leaves the proteins largely intact and insoluble, making fish meal less functional in liquid formulations.

139. (B) The weight in grams required to depress a standard plunger 4 mm into a prepared 6.67% gelatin gel.
Bloom strength is a standardized physical measure of gelatin gel firmness. It is defined as the weight in grams required to depress a specific cylindrical plunger exactly four millimeters into a gel containing 6.67 percent gelatin by weight that has been prepared and aged under highly controlled temperature and temporal conditions.

140. (A) Both A and R are true and R is the correct explanation of A.
Lycopene extracted from tomato waste is a highly lipophilic carotenoid with very low solubility in water. When formulated with a lipid carrier, the dietary fats stimulate the secretion of bile salts and pancreatic lipases, facilitating the formation of mixed micelles. These micelles solubilize lycopene, enabling its efficient transport across the intestinal mucosal membrane and enhancing bioavailability.

141. (A) Quantitative analysis of punicalagins, absence of contaminants, and acute toxicity studies
To secure regulatory approval from FSSAI for a novel by-product ingredient, a company must provide robust safety data. This includes quantitative profiling of the active bioactives like punicalagins, verification of the absence of chemical or microbial contaminants, and comprehensive acute and sub-chronic toxicological studies. These elements are critical to demonstrate safety under intended consumption levels.

142. (C) Composting – Thermal recovery of energy via direct combustion
Composting is a biological process involving the aerobic decomposition of organic waste

Click Here to Buy book on Amazon

into nutrient-rich humus by microorganisms. It does not involve thermal recovery of energy or direct combustion, which are characteristics of incineration processes. Other terms are correctly defined: downcycling lowers material quality, upcycling increases environmental value, and bioremediation utilizes microbes to remove pollutants.

143. (A) P-III, Q-IV, R-II, S-I
Circular economy concepts are illustrated by specific food industry practices. Slicing optimization reduces waste generation at the source. Utilizing returnable glass bottles exemplifies the reuse of packaging materials. Processing misshapen vegetables into purees recycles surplus food into new products. Finally, anaerobic digestion recovers energy from waste by generating biogas.

144. (C) Complete elimination of the need for any primary agricultural crops
The biorefinery concept in the food sector maximizes value extraction from biomass and by-products, diversifying income, reducing disposal costs, and producing biochemicals. However, it cannot completely eliminate the need for primary agricultural crops, as food production still fundamentally relies on primary agriculture to generate the food raw materials that yield these processable by-products.

145. (B) Keratinase – Poultry feathers
Keratinase is a highly specialized proteolytic enzyme that specifically hydrolyzes keratin, the insoluble structural protein that makes up poultry feathers, converting it into digestible amino acids. Conversely, pectinase acts on pectin in plant tissues, lipase hydrolyzes lipids rather than hemicellulose, and cellulase breaks down cellulose rather than dairy lactose in cheese whey.

146. (C) Statement I is correct but Statement II is incorrect.
Hesperidin is a major bioactive flavonoid present in citrus peel waste. However, hesperidin is highly insoluble in cold water and neutral aqueous solutions. Its industrial extraction requires alkaline conditions to solubilize the molecule by deprotonating its phenolic hydroxyl groups, followed by neutralization with acid to precipitate the purified compound, rather than simple water extraction.

147. (A) Extract β-carotene → dry residues for fiber supplements → compost remainder.
A cascade utilization strategy for carrot pomace maximizes value by sequentially recovering components. First, high-value beta-carotene is extracted. Second, the remaining solid residue is dried and milled to produce dietary fiber supplements. Finally, any remaining organic residues are composted to regenerate agricultural soils, fully aligning with the circular economy principles of waste minimization.

148. (C) May contain crustacean derivatives
Under food packaging and labeling regulations, any edible film or coating derived from a major allergen must be clearly labeled to protect consumers. Because chitosan is commercially extracted from the exoskeletons of shellfish, an edible film made from it must bear a prominent allergy warning stating that the product may contain crustacean derivatives.

149. (A) A linear economy promotes the maximum extraction of value from every kg of raw material input.
A linear economy follows a "take, make, dispose" model, treating by-products as waste and failing to extract value. In contrast, a circular economy promotes the maximum extraction of value from every kilogram of raw material input by looping by-products back into the production chain. Valorisation is therefore a key pillar of this transition.

150. (D) Cause: Glucosinolates; Effect: Interference with thyroid function and reduced feed palatability.
Glucosinolates are toxic anti-nutritional factors found in rapeseed and mustard meals. When ingested by animals, their breakdown products, such as isothiocyanates, interfere with iodine uptake by the thyroid gland, leading to goiter and metabolic disorders. Additionally, these compounds possess a bitter taste that significantly reduces feed palatability and voluntary feed intake in livestock.

www.nodia.in

Downloaded from www.pdf.tube

115. (A) Germ – Recovered for oil extraction due to lipid and vitamin E content
The germ represents the nutrient-rich embryo of cereal grains and is recovered during milling to extract valuable oil, which is exceptionally rich in unsaturated fatty acids and vitamin E. In contrast, the endosperm is the main starch storage tissue, the husk is the highly fibrous outer protective hull, and the aleurone is the protein-rich outermost endosperm layer.

116. (A) Both Statement I and Statement II are correct.
Mechanically deboned meat is a paste-like product produced by forcing animal carcasses or bone-in cuts under high pressure through a fine sieve to separate remaining muscle tissues. Because this mechanical process scrapes the bone surfaces, microscopic bone fragments can pass through the sieve, resulting in a significantly higher calcium content compared to hand-deboned intact muscle cuts.

117. (A) Chitosan; positive charge
The active polymer recovered from shrimp shell waste for edible films is chitosan. In mildly acidic solutions, the free amino groups along the chitosan polymer chain become protonated, imparting a strong positive charge to the molecule. This polycationic nature is responsible for the polymer's solubility, film-forming capabilities, and inherent antimicrobial activity against foodborne spoilage organisms.

118. (D) Essential oil extraction (cold pressing/ distillation) → Pectin extraction (acid hydrolysis) → Anaerobic digestion of the residue (biogas))
A cascade biorefinery approach maximizes economic value by extracting components in descending order of value and sensitivity. First, gentle cold pressing or distillation extracts high-value essential oils. Second, the remaining peel residue undergoes acid hydrolysis to extract pectin. Finally, the remaining lignocellulosic solids are processed via anaerobic digestion to generate biogas, leaving minimal waste.

119. (B) Pentose sugars (like xylose from hemicellulose) are fermented just as rapidly and efficiently as glucose by standard baking yeast.
Standard baking yeast, Saccharomyces cerevisiae, lacks the metabolic pathways required to ferment pentose sugars like xylose and arabinose, which are major components of hemicellulose. These pentoses remain largely unfermented unless genetically modified yeast strains are utilized. In contrast, hexose sugars are rapidly fermented, and simultaneous saccharification and fermentation is a highly efficient, established industrial process.

120. (C) Cause: High FFA; Effect: Alkaline neutralization causes saponification and high oil loss.
Crude rice bran oil often contains high levels of free fatty acids. If chemical refining with alkaline agents like sodium hydroxide is applied, these FFAs react directly with the alkali to form soapstock. This saponification reaction occludes and entrains large quantities of neutral oil, resulting in exceptionally high refining losses and rendering physical refining a preferred alternative.

NODIA

121. (D) Pectin
Pectin is a highly valuable structural polysaccharide extracted commercially from the white inner peel layer, known as the albedo, of citrus fruits. It functions as an exceptional gelling agent, thickener, and stabilizer in the food industry. Other hydrocolloids like carrageenan and agar-agar are derived from marine seaweeds, while xanthan gum is produced by bacterial fermentation.

122. (B) 1, 2, and 4
Lactose recovered from whey permeate is widely used as a pharmaceutical excipient, enzymatically converted into prebiotic lactulose, and added to infant formulas to match the carbohydrate profile of human milk. However, lactose has a very low sweetening power, possessing only about fifteen to thirty percent of the relative sweetness of sucrose, limiting its use as a primary sweetener.

123. (B) They are added to functional foods to improve joint mobility and skin elasticity.
Collagen peptides are widely used as functional ingredients in dietary supplements and enriched foods. Clinical studies demonstrate that consuming these low-molecular-weight, highly bioavailable peptides stimulates the synthesis of endogenous collagen, thereby improving skin elasticity, reducing wrinkles, and supporting joint health. They do not form rigid gels or serve as baking leaveners or acidifying agents.